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NORTH STAFFORDSHIRE

Naturalists' Field Club

AND

ARCHÆOLOGICAL SOCIETY.

ANNUAL REPORT

AND

TRANSACTIONS.

VOL. XXVI.

Newcastle-under-Lyme:

G. T. BAGGULEY (LATE DILWORTH), PRINTER, HIGH STREET.

1892.

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EXCURSIONS AND EVENING MEETINGS,

FOR 1892-93.

EXCURSIONS.

1—Wednesday, April 20th, BURY RING & S. THOMAS' PRIORY, STAFFORD.
Leader—Mr. C. LYNAM.

2—Thursday, May 19th, ... TISSINGTON AND PARWICH.
Leader—Mr. ALEX. SCRIVENER.

3—Saturday, June 18th ... ... NEWPORT AND AQUALATE.
Leader—Mr. W. WELLS BLADEN.

4—Wednesday, July 13th, to Monday, July 18th THE ROMAN WALL.
Leader—The SECRETARY.

5—Thursday, August 25th ... ... NEEDWOOD FOREST.
Leader—Mr. T. S. WILKINS.

6—Saturday, September 17th ... ... ECTON AND WARSLOW.
Leader—Mr. A. T. DANIEL.

7—Monday, October 17th ... ... THROWLEY HALL.
Leader—Mr. MASEFIELD.

EVENING MEETINGS.

1—Thursday, November 17th ... ... STAFFORD.
Local Secretary—Mr. W. H. RIDGE.

2—Thursday, January 19th ... ... TUNSTALL.
Local Secretary—Mr. D. SHERWIN.

3—Tuesday, February 28th ... ... CHEADLE.
Local Secretary—Mr. J. R. B. MASEFIELD.

4—Thursday, March 23rd... ANNUAL MEETING ... STOKE.
Local Secretary—Mr. JAMES KIRKBY.

The Treasurer in Account with the North Staffordshire Naturalists' Field Club

AND ARCHÆOLOGICAL SOCIETY.

STATEMENT OF ACCOUNTS FOR THE YEAR 1891.

Dr. RECEIPTS.

	£	s.	d.
By Subscriptions	91	0	0
„ Entrance Fees	12	0	0
„ Copy of "Transactions" sold	0	5	0
„ Report sold	0	1	0
	£ 103	6	0

EXPENDITURE. **Cr.**

	£	s.	d.
To Balance due to Treasurer	6	3	8
„ Rent of Library Room	2	10	0
„ Stoke Meeting and Committee Room ...	5	2	0
„ Summer Meetings—Expenses	7	4	3
„ Hanley Winter Meetings, (2)	5	19	11
„ Bagguley for Printing and Postage of Circulars	44	11	11
„ Collecting Subscriptions and Collector's Postage	6	11	9
„ Balance in hand	25	2	6
	£ 103	6	0

March 16th, 1892.

Examined and found Correct,

E. EARL.

THE GARNER MEMORIAL FUND.

	£	s.	d.
Sum in District Bank, March 19th, 1891	39	11	0
Subscriptions received since	22	18	6
Interest	0	15	9
	£ 63	5	3

JAMES KIRKBY,

Secretary.

ANNUAL REPORT.

REPORT.

Read at the Twenty-Seventh Annual Meeting, held at Stoke, on Thursday, March 17th, 1892.

THE year which comes to a close with this Twenty-Seventh Annual Meeting, if comparatively uneventful, has yet witnessed the North Staffordshire Naturalists' Field Club and Archæological Society steadily and quietly pursuing its useful course. The fixtures for the year have, month by month, been brought to a successful issue, and much good work has been done both by individual members, and in the Sections, as the reports of their Heads which for the first time represent all that are at the present time constituted, amply certify.

On one most important point there is distinct cause for congratulation. For some years, as is well known, the income of the Club has hardly been sufficient to meet the expenditure, but this difficulty now happily disappears, and it will be found that at length there is a very tangible balance on the right side; for this we have to thank the careful management of the Treasurer, and no one will be better pleased than the Collector Mr. W. H. Earl, who has been most assiduous in collecting subscriptions, and has done much towards clearing the list of those members, who, having dropped their connection with the Club, were notwithstanding unwittingly retained on the roll.

The Excursions have been duly carried out in accordance with the list fixed at the last Annual Meeting, with the exception that at three of them a slight alteration of the date had to be made, in each case for a sufficient reason: they were, in accordance with the rule that has been in vogue for many years, distributed over the seven months of the year beginning with April, when the lengthening day brings back the swallow and the cuckoo and other

summer visitants, and ending with October, soon after which their place is taken by the fieldfare and the redwing, those harbingers of fast approaching winter. The localities visited are recorded below, together with the dates of the excursions, and the names of their leaders: the figure following represents the number of members who were present.

1—The Headwaters of the Trent, on Monday, April 20th. Leader: Mr. A. T. Daniel. 34.

2—Norbury, Ellaston, Wootton Woods, the Weaver Hills and Ilam, on Saturday, May 23rd. Leader: Mr. T. S. Wilkins. 55.

3—Oakamoor, Cotton and Star Wood, on Saturday, June 27th. Leader: Mr. W. S. Brough. 70.

4—Worksop and the Dukeries, on Wednesday, July 22nd, to Monday, July 27th. Leader: Mr. T. Wardle, President. 27.

5—Atherstone, Bosworth Field, and Shenton, Dadlington and Stoke Golding Churches, on Thursday, August 27th. Leader: Mr. F. Gee. 55.

6—Manchester Ship Canal, Runcorn to Eastham, on Thursday, September 17th. Leader: Mr. F. Barke. 80.

7—Doveridge, Sudbury, Fauld Gypsum Mines, and Tutbury, on Tuesday, October 20th. Leader: Mr. John R. B. Masefield. 36.

These figures show an average attendance of 51 at each Excursion: last year it was only 40, but as was noted then this was ten below the usual average, so that last year the loss was fully recovered. In the matter of weather, which is so important a factor on these occasions, the Club was perhaps scarcely so fortunate as usual: the opening day was exactly the same as in the preceding year, when the Club went to Repton; a dry cold east wind was blowing, but only with sufficient force to give zest to the walk along Congleton edge: the Norbury day was all that could be wished—bright and pleasant; the June Excursion fell on a wet morning, which was however compensated for by a pleasant afternoon; the long Excursion was favoured with good weather throughout; a great contrast to the day on which the August Excursion was made, when it rained more or less all the time; the long walk from Runcorn to Ellesmere Port, about 9 miles, was effected under most favourable conditions; the day was breezy and dry; had the ground

been wet and slippery, great discomfort would have ensued, and it is doubtful whether some of the party would not have been compelled to give in, for the way chiefly along the tram lines was rough, and the sleepers placed at unequal distances made the walking very fatiguing; at the October Excursion the weather was fine and bright, although in the middle of the day, a shower came smartly down, contrary to expectation it soon cleared away: but the ground was very wet, and the paths near the Gypsum Mines being on the marl were ankle-deep in mud, and consequently slippery and tiring. And yet, notwithstanding any drawbacks on the score of weather, the Excursions were one and all thoroughly enjoyed, and were made most interesting and instructive by the careful arrangements of their Leaders.

There have been the usual number of Evening Meetings during the winter months: they were held at the following places on the dates given: the name of the Local Secretary, and the number of members and others attending are also appended.

1—Hanley, on Wednesday, Nov. 18th. Mr. J. W. Moore. 72.

2—Leek, on Saturday, January 23rd. Mr. S. Unwin. 180.

3—Newcastle, on Thursday, Feb. 18th. Mr. W. H. Earl. 66.

There was a slight change of date of the Hanley meeting. The third meeting was originally intended to have been held at Stafford. But owing to alterations at the Wragge Museum and other causes it was found impossible to arrange it. It is proposed however that Stafford should be included in the list of towns having its own Secretary and Treasurer; and that an Evening Meeting should be fixed to be held there next winter: there can be no question that it will be to the interest of the Club to include the County Town within its area. The Local Secretary at Newcastle on being appealed to undertook, on very short notice, to hold it there: and he had his reward in a very successful and pleasant meeting. The average attendance at the three meetings is 106. This is much larger than last year or the year before, but in 1889 it was 146. It is to be expected that the attendance at the Evening Meetings will fluctuate; so much depends on the localities where they are held. As has been observed on a former occasion, the smaller towns, where evening attractions are far fewer than in the large ones, nearly always produce the best results so far as the attendance is concerned.

Twelve Papers and Addresses have been read and given during the year, being one more than last year: they have been of the usual varied nature, as might be expected from the many branches of science comprised within the scope of the operations of the Club; and they have been full of interest, for which the names of the authors are a sufficient guarantee: a list is appended, giving the titles and the names of the writers or speakers :—

1—The Head Waters of the Trent, by Mr. A. T. Daniel.

2—The Palimpsest Brass in Norbury Church, Derbyshire, by Mr. A. A. Armstrong.

3—Worksop Priory Church, by the Rev. H. T. Slodden, M.A.

4—The Geological Features of the District round Worksop, by Mr. T. Wardle, F.C.S., F.G.S.

5—The Gypsum Quarries and Mines at Fauld, by Mr. F. Barke.

6—Botany as a Science and Recreation, with notes on some of the Plants found in the Biddulph district, by the Rev. W. Hunt Painter.

7—Foraminifera, by Mr. W. Burton, F.C.S.

8—The Indian Collection in the Nicholson Institute, Leek, described by the Exhibitor, Mr. T. Wardle.

9—The British Association Meeting at Cardiff, by Mr. J. T. Arlidge, A.M., M.D. Lond.

10—Some remarks on Apis Mellifica, the common Hive Bee, by Captain T. J. Smith.

11—Introductory Paper on our Local Reptiles and Amphibians, by Mr. J. R. B. Masefield, M.A.

12—A few jottings on some Staffordshire Camps, by Mr. C. Lynam, F.R.I.B.A.

Of these, eight were papers; the first, third, seventh and eighth were delivered orally. For the last two papers special thanks are due to their writers for their willing consent to prepare them on very short notice. Your Committee have much pleasure in making the suggestion that these papers or abstracts of them be printed along with the Annual and Sectional Reports.

Dr. Arlidge, our Delegate to the British Association for the Advancement of Science, attended the late meeting at Cardiff, and has reported on it and on what the Club may do in response to its suggestions.

The Council were called together on November 20th to receive a deputation from a meeting convened at Stoke a few days previously, to consider the advisability of establishing a Society for the purpose of obtaining a Photographic Survey of the County of Stafford, which had been adjourned in order to learn whether the Club would be willing to take up the work, seeing that its object was already partly covered by the Photographic Section. The deputation which consisted of Mr. Alfred J. Caddie, Mr. Alfred Meigh, and Mr. E. B. Wain, explained the views of the promoters of the meeting they represented. Your Committee feeling that the proposed work was beyond their present powers unanimously passed the following resolution, — "That whilst desirous to assist in every way the object which the proposed new Photographic Society has in view, this Committee cannot recommend its adoption, as part of the work of the Club: at the same time they desire to express their best wishes for the success of the proposed undertaking." The members of the deputation were thanked for their courtesy in attending the meeting of the Council, and for the explanation of their views.

Your Committee regret that the memorial of the late Mr. Garner has not yet been founded: it will be remembered that it has been decided that it should take the form of a Silver Medal, to be called the "Garner Medal," and to be given every other year for original work connected with the district in any of the branches of Science adopted by the Club, the option of a gift of scientific books accompanied by the medal in bronze being allowed. Although this is now the only form of memorial of Mr. Garner before the public, it cannot be said that the project has been supported, as it ought to have been, either within the Club, or from outside, for when this became the only memorial contemplated Dr. McAldowie issued an appeal to the principal residents in North Staffordshire. Mr. Kirkby will tell you exactly, what the amount subscribed and paid into the bank is: it will probably be found that after investing £50, the remainder will be almost sufficient to pay for the die: it is however a matter for regret that there are not available funds to enable the medal to be awarded annually.

Although during the year now drawing to its close, death has happily not taken away any of our more prominent members, yet

the Club is decidedly poorer by the removal from the district of Mr. James Yates and the Rev. W. Hunt Painter. Like Mr. Garner, Mr. Yates was an original member of the Club, and was elected one of its Vice-Presidents in March, 1872: he has occupied the President's chair twice, in the years 1873-4, and 1884-5 No member has taken a keener interest in the proceedings of the Club, or done more to promote its welfare. Mr. Yates has been a leader of Excursions: he has read several papers, and from the Evening meetings he has scarcely ever been absent: to his extensive reading, and to his quick appreciation of any question appertaining to Natural Science, the Club has often been indebted for those incisive remarks, which at once shewed the depth of his reasoning, and the grasp he had taken of the subject under discussion. Your Committee recommend that the Club do itself honour by placing Mr. Yates's name on the very select list of honorary members.

Another loss to the Club is the approaching departure from Knypersley of the Rev. W. Hunt Painter. Mr. Painter is a thoroughly earnest Botanist, and by the two papers he has read before the Club he has done what he could to prevail upon the members to work up his favourite branch of Natural History. He has been most anxious that a new North Staffordshire list of Plants should be compiled, and towards this very desirable end he has made a beginning by handing in for publication a very complete list of the plants of the Biddulph district. Botanists have never been numerous in the Club, and it can ill afford to lose so painstaking a member as Mr. Painter.

At the last Annual Meeting there were on the roll 374 members. Since then there have been 54 elections into the Club, and 52 withdrawals from it. The total number therefore at the present time is 376, or a gain of two only upon last year's list. Adding however the seven names nominated at Newcastle, and elected to-night, the total number is 383, or 9 more than last year. Of these 383, three are honorary members, and 66 are ladies. The Committee hope that another year they will be able to report that the number has again reached 400, and they are of opinion that with the co-operation of the present members this desirable result might easily be effected.

It now only remains for your Committee to bring their Report to a conclusion, and in doing so they would remind the general body of members that the welfare of the Club is to a very large extent in their hands: for although through want of leisure and lack of opportunity they may not be able to take up seriously any

of the studies, for the furtherance of which the Club exists, or contribute their quota to its records, yet even in this respect your Committee are of opinion that almost all might give useful help by noting down such facts of Natural History as may continually be observed as well in their own gardens as in their holiday excursions, *e.g.* the time of the arrival and departure of the different species of swallows, the first call of the cuckoo, the date of the flowering of indigenous plants, and a host of other similar facts, that are happening day by day before our eyes. But however this may be, it is quite certain that every member may be helpful to the well-being of the Club by inducing new members to join its ranks, and by themselves regarding it as a duty they owe their fellow members to be present at such of the Excursions and Evening Meetings as fall within their reach.

The Club is once more indebted to Mr. J. B. Piercy for a report of the Rainfall at three stations in North Staffordshire.

A weather chart, the result of observations taken at Hanley, is contributed by Mr. A. E. Nevins, the chairman of the new Meteorological Section, and appears in this volume for the first time.

ANNUAL ADDRESS.

By the PRESIDENT, THOMAS WARDLE, F.C.S., F.G.S.

THE ENTOMOLOGY AND USES OF SILK.

I feel that a great compliment has been paid to me to-night in having been unanimously asked to occupy the Presidential Chair for another year.

I have accepted this honour with some reluctance, because it is possible for one man to be in the same office too long, and that more useful members are thereby prevented having the opportunity of giving valuable services to this Association, and through it, to Science.

I beg, however, to thank you all, ladies and gentlemen, for your confidence in me, which is, at the same time an endorsement of your satisfaction for the past year, and your trust in me that I shall do my best during the present year.

My affections are very much bound up in this North Staffordshire Field Club and Archæological Association, for several important reasons.

First, that we are all lovers of Natural History, and admirers of the glorious world of nature; collaborateurs of those in the past who have tried to discover some of her mysterious laws, and those of the present and future, who are, and who ever will be, finding for themselves untold pleasure in the investigation of those forces which have such manifold play, and with such varying and wonderful results as can only be completely known to the Great Architect of a Universe who made "all things visible and invisible;" from the worlds which we are permitted to see afar, to those beyond, in illimitable space, to the lesser world in which we live,

and which we are permitted to examine, and to take pleasure therein.

I have often thought of that unique and comprehensive expression in the creed of St. Athanasius, "maker of all things visible and invisible." Of things visible, how much more do we not now know than the framer of the phrase, of the constitution of the earth's crust; the structure, functions and properties of plants, the whole animal world, and the insight we have been able to obtain as to their composition by the aid of chemical science.

Of the "things invisible" what vast revelations have been given to us by the microscope, since the day which first heard the recitation of that article of our faith, revelations even to the very gate of that knowledge by which the origin and cause of life is centred.

The revealing to sight of that formidable world of bacteria, their functions, uses and dangers, is progress which would hardly be credible to the old observers of natural science and history. Our love for this progressive knowledge is inborn; from Adam, who is recorded to have had the beasts of the field and the fowls of the air brought to him to see what he would call them; "and the man gave names to all cattle, and to the fowls of the air; and whatsoever the man called them, that was the name thereof." How, since that ancient past, has that naming been continued; and how we are yet infected with the desire to find a new species, and to add a new name to an already vast nomenclature!

Of Solomon it is written that "he spake of trees, from the cedar tree that is in Lebanon even unto the hyssop that springeth out of the wall. He spake also of beasts, of fowl, of creeping things, and of fishes." (1st Kings, iv, 33 v.) And we are reminded, at least those of us who heard of our friend Mr. Carr's eloquent recital of the Talmud story of the bees, on the Sunday afternoon under the trees at Clumber last year, in words partly his own, of Solomon's knowledge of insects.

As our Annual Meeting is not rigidly confined to Science, but a friendly occasion to report progress, perhaps you will pardon me if I read these verses; they are sure to interest at least those who have not heard them before:—

When Solomon was reigning in his glory,
Unto his throne the Queen of Sheba came,
(So in the Talmud you may read the story)
Drawn by the magic of the monarch's fame,
To see the splendours of his court; and bring
Some fitting tribute to the mighty King.

Nor this alone; much had her Highness heard
What flowers of learning graced the royal speech;
What gems of wisdom dropped with every word;
What wholesome lessons he was wont to teach
In pleasing proverbs; and she wished, in sooth,
To know if rumour spoke the simple truth.

Besides, the Queen had heard (which piqued her most)
How through the deepest riddles he could spy;
How all the curious arts that women boast
Were quite transparent to his piercing eye,
And so the Queen had come—a royal guest—
To put the sage's cunning to the test.

And straight she held before the monarch's view,
In either hand, a radiant wreath of flowers;
The one bedecked with every charming hue,
Was newly culled from nature's choicest bowers;
The other, no less fair in every part,
Was only wrought by imitative art.

"Which is the true and which the false," she said.
Great Solomon was silent. All-amazed,
Each wondering courtier shook his puzzled head,
While at the garlands long the monarch gazed,
As one who sees a miracle, and fain,
For very rapture, ne'er would speak again.

"Which is the true," once more the woman asked,
(Pleased at the fond amazement of the king,)
"So wise a head should not be hardly taxed,
Most learned liege, with such a trivial thing;"
But still the sage was silent; it was plain
A deepening doubt perplexed the royal brain.

While thus he ponders, presently he sees,
Hard by the casement (so the story goes),
A little band of busy, bustling bees
Hunting for honey in a Sharon rose.
The monarch smiled, and raised his royal head;
"Open the window!" that was all he said.

The window opened at the King's command,
Within the room the eager insects flew,
And sought the flowers in Sheba's dexter hand.
And so the King and all the courtiers knew
That wreath was natures; and the baffled Queen
Returned to tell the wonders she had seen.

My story teaches (every tale should bear
A fitting moral) that the wise may find
In trifles, light as atoms in the air,
Some useful lesson to enrich the mind ;
Some truth designed to profit or to please,
As Israel's King learned wisdom from the bees !

Apropos of bees and apiculture, I learned the other day from the Board of Trade, that a bee must visit 218,750 flowers for each ounce of honey gathered, and that the largest beekeeper in the world is Mr. Harbicon, of California, who possesses 6,000 hives, supplying 200,000 lbs. of honey per annum. The United States is the greatest honey producing country in the world ; it has 2,800,000 hives belonging to 70,000 rearers, and producing annually 61,000,000 lbs. of honey. An enemy of the bees is a friend of mine, the larvæ of the moth Galleria cerella, creeping into the hive and boring into the honey cells, feed upon the honey ; they make silken cocoons in the cells from which the moths emerge, as you may see in this case.

In the two-fold objects for which the Field-Naturalist part of this Association exists, namely, the praise of nature by our observation of it in our excursions, and in the examination into its constituent parts, we have the encouragement of a greater teacher than the two I have just mentioned ; He who bid us consider the lilies of the field ; how they grow ; that they toil not, neither do they spin, and that yet Solomon in all his glory was not arrayed like one of these ; and in so considering do we not forget our toil and the care of to-morrow whilst enjoying the collective and diversified enquiries which occupy us in our monthly Excursions, both amongst the lilies of the field and the birds and denizens of the air and landscape ; but our attention and pleasure is not confined to the history which is termed natural ; there is also a living history, so to speak, of our own race as seen in the various forms of sepulture, defense, worship, and of later times, of residence, with which our County abounds.

To these, not only our interest but our study and care is given, and the County owes us no small debt of gratitude for bringing before it, by patient and long continued investigation and description, the instruction to be derived and imparted by those of our members who so very ably and lovingly give themselves to the duty.

These are our raisons d'être for the establishment and continuation of this Association, whose work last year will I think compare favourably with that of the past, and whose future is full of

promise and encouragement to both young and old enquirers after truth.

Another thought should give us hope and determination. The example of the untiring and valuable work done in our Association, by the late Mr. Garner especially, and many others whose record is to be found in our annual reports. Amongst others of our present time I shall mention only four out of a goodly company of zealous workers:—Drs. Arlidge and McAldowie, our former Presidents, who have so distinguished themselves by their thoughtful and learned contributions to our Annals; Mr. Lynam, whose portrait ought to be painted with a drawn sword in his hand, keeping off the restoring vandals from our ancient camps and beautful mediæval architecture, all traces of which he so jealously guards, in order that we may enjoy what I call the visible and veritable history of our County unmarred by the falsifying process so happily expressed by the Germans "Restaurirt ist ruinirt."

Lastly, no greater encouragement can be given to the continuance of our collective work than in the splendid constancy and devotion given for nearly thirty years by our excellent Secretary, the mainspring of our success and work. He has the happy knack of welding together all sorts and conditions of men and women into a joyous and harmonious whole, until we know nothing of "classes and masses," and I am sure I shall be expressing the opinions of every member of our Club and Association, that his name will live in the annals of the County long after many of its principal actors are forgotten. To him our earnest and grateful thanks are due, and I have long wished for an unbidden opportunity of expressing my convictions in this respect.

With such associationship as I have mentioned, permit me to advocate a devoted and earnest determination of each and every member, particularly the young, to try to be present at each Excursion, and if possible to beat past records in field-work and observation.

There is much to do that is new; our sectional work needs strengthening. I think the Geological Section, if I may say so, carried off the palm last year. I wish the members of other Sections could catch the enthusiasm which inspired us last year in tracking a volcanic dyke mostly hidden, from Trentham to Swinnerton, where we may say we fell literally and really into a trap, well a trap-pit, in the shape of a huge quarry of upheaved larva, and returned laden with ashes, and information healthily sought.

Having said this much, mainly hoping to stimulate our new and younger members to follow up the work of the older votaries of knowledge seeking, I will turn to the subject of my Presidential Address.

I have selected for consideration the study of a delightful part of entomology, which has a beautiful, important and economic outcome. The title of my paper is "The Entomology and uses of Silk."

I have selected this subject because it is one at which I have of late worked most, and in both aspects I have for some years been collecting silk-producers, not so much for their interesting larval forms, or for the great beauty and variety of their imago states, but in order to study the structure and physical properties of the fibres which their larvæ seriposit for a covering and protection during the time they assume their torpid chrysalide state, a covering, which, to serve economic ends, is from a few species, ruthlessly torn by man to provide in other forms and in other colours, fabrics and trimmings for human coverings and adornment, as well as of thread to sew them with.

When I began this delightful and interesting study many years ago, my knowledge of silkworms, their moths and cocoons, was limited to about 20 species, and they chiefly Indian. It was then known only to a few entomologists that there existed many species of silk secreting catterpillars in England and elsewhere. To-day, after a world-wide search, I am able to hand a new list to our Field Club of 27 families, numbering 170 genera, with at least 630 species, all of which make silken coverings, but often as varied in shape, size, build and differences of fibre, as the appearance of their moths, the last stage in the curious life-history of this class of insects.

Of these 630 species, there are some exhibiting wonderful characteristics. There is the tiny caterpillar of the smaller moths, not more than half an inch in length, and from this can be shown larvæ of all sizes, up to the giant Tussur, two of which I took out of a Terminalia Tree in a Missionary's garden in the Manbhoom Jungles of Bengal, each 5 inches in length and $\frac{3}{4}$ of an inch in thickness. I hope to show a representation of one of them on the screen presently. Then there are the catterpillars which lead a solitary life, and shroud themselves in their silken envelopes when they happen to have arrived at caterpillar maturity; not so with other species, for there is the Cricula Trifenestrata of India, which

lives in companionship with its fellows, and when cocoon-making time comes, they work side by side, interlacing their silken threads until they lie hidden in a colony as you see them here.

Others like this specimen from Africa, first weave a bag of silk, then go inside to envelop themselves singly with a separate cocoon. This bag is full of them.

Another species is of a more military order. Its members never take their walks alone or in pairs, but always in line, one leading the rest, even if hundreds are following and so closely that they look like a long length of coloured cord along the ground or upon a tree, a most remarkable sight of gregarious habit.

I brought some home last year from the woods of Monte Carlo, and one evening I went to my greenhouse and found them on their slow march exactly in a straight line, in single file, nose to tail, along the top of the hot water pipes. In the Riviera you may see hundreds of their bulbous cobwebby bunches in the fir trees; these are their hiding places. They rest in them in the day and come out at night to feed upon the firs. These white bunches are their houses of silk, tied from all points to the fir branches. Some of them are larger than footballs. The insect is known by the name of Bombyx, or more properly, Cnethocampa processionea. Its silk has not been turned to any profitable account, but it could be used for spinning; it could not be reeled like the cocoon of the Bombyx Mori.

There is a caterpillar in Demerara whose legs only go half the length of his body; he goes about like a snail with his house on his hinder parts, the leg portion of his body for crawling, the legless part carrying his cocoon.

But I should weary you if I attempted to recount a hundredth part of the list up to date I have brought here.

With the multitudinous variety of moths you are well acquainted, with their enchanting shapes and colours, and with their pretty patterned wings, so I will content myself with showing you a few of the more important and interesting species on the screen at the conclusion of my paper.

Silk is also produced by many species of spiders, also by the larvæ of the Ichneumem flies. On the table is an interesting collection of these flies whose larvæ have laid their eggs in the

bodies of caterpillars. After the caterpillars have made their cocoons and passed into the chrysalide state, the tiny ichneumen eggs hatch and their larvæ surround themselves with a silken thread 6 or 8 times finer than the Bombyx fibre, until a small cocoon results in considerable numbers not larger than rice grains, and occupying the interior of the large cocoon to the destrnction of the chrysalis. In day time these ichneumen flies emerge from their little silken shrouds, and eat their way through the silken prison of the larger cocoon.

Another class of insects, the Coccidae much studied by Mr. Newstead of Chester, also make tiny cocoons which very much resemble silk, under the microscope, but the fibres, which dissolve in turpentine, prove them to be of a waxy and not a silken nature. There is a small collection on the table. These Coccids are found on grass and on the bark of trees.

And now I will as briefly as I can, touch upon their uses to man. First comes the little Bombyx Mori, whose caterpillars yield us the ordinary silk of commerce, from which the finest fabrics are made; whose ancestors found such favour with the wives and daughters of Chinese Emperors thousands of years ago, that they delighted themselves in unwinding the silk from the cocoons and in making it into threads for embroidery and for textile work, also in dyeing it, and afterwards in weaving it into patterned fabrics. For centuries in ancient times, it was the pleasure and pride of high-born ladies to broider and weave. Thus in the 3rd Illiad:—

> "Meantime to beauteous Helen from the skies,
> The various goddess of the rainbow flies.
> Here in the palace at her loom she found,
> The golden web her own sad story crown'd;
> The Trojan wars she weav'd, herself the prize,
> And the dire triumph of her fatal eyes."

I have here two very small pieces of silk, both found in Egypt in ancient Christian Coptic graves by my friend Mr. Flinders Petrie, the renowed Egyptian explorer. One is of the 4th century, found at Achmim, and is ornamented all over with Maltese-shaped crosses. I have had it reproduced in Germany. The other is of the 6th century, found at Fayum; it is a very interesting specimen of weaving in stripes. It is, too, remarkable for the beauty and permanence of the dyes to which it owes its colour. I have brought a reproduction of it, recently woven in Scotland, the herring-bone texture of weaving is copied, also the stripes and the dyes and colours are exactly reproduced. That the colours should have stood

unfaded for thirteen hundred years is marvellous, and proves the excellence of their dyes, and the high perfection in tinctorial art of their dyers.

SCRAPS OF SILK HISTORY.

More is known of the early history of silk in the West than in the East, but dating only from Classic Greek and Roman times.

Aristotle wrote on the life changes of the Silkworm, and gives to Pamphile, the daughter of Plates, the honour of first reeling silk on bobbins for weaving into gauzy fabrics, which made the Island of Cos famous in history and song, for the Coan vest was the most prized garment of the classic lady. It was so transparent that it allowed the body to be seen through its clinging folds; and Horace says of it :—

> "As if unclothed she stands confessed
> In a transparent Coan vest.

Tibullus speaks of a Coan vest for girls :—

> "She may these garments wear, which female Coan hands
> Have woven, and in stripes disposed the golden bands."

A statue to Vertumnus had this inscription on its base :—

> "My nature suits each changing form,
> Turned into what you please I'm fair,
> Clothe me in Coan, I'm a decent lass,
> Put on a toga, for a man I pass."

Plutarch dissuades the prudent wife from wearing silk. Martial speaks of silken fillets for the hair and other silken goods being sold at the Viscus Tuscus at Rome. Galen recommends silk thread for the tying up of blood vessels; America now parades this as her new surgical invention; verily there is nothing new under the sun! Heliogabalus was the first Roman to wear a holosericum or robe of silk; he also kept by him a silken rope of purple and scarlet to hang himself with when the day of his destiny was over. In the reign of Tiberius, women of rank only were allowed to wear eastern silks, "oriental sericum." Aurelian refused his Empress a silken shawl she coveted, because of its costliness, weight for weight in gold. But Julius Cæsar used silken curtains, and wore silk, when he appeared in public, dyed with the purple of Tyre, the product of Murex Trunculus and Murex Brandaris, two species of Mediterranean shell-fish. There is also a third, Purpura lapilla, and all are

found from Italy to Tyre. A Nicaraguan species, named Purpura patula, and our own common whelk, also yield the dye. In the days of Marcus Aurelius Antonius, shawls and robes, and scarves had so accumulated in the silk presses of the various empresses, that he, being a philosopher and economic ruler, sold them all by public auction in the Forum of Trojan, to help the exhausted treasuries. The early Christians protested against the luxury of silk. Cyprian, the Bishop of Carthage, said, "Those who put on silk and purple cannot put on Christ."

There is preserved in the Edict of Diocletian in A.D. 303, the maximum prices allowed by him for tailoring in silk, as follows:—

To the tailor for silk lining a fine vest.....	6 denarii.
To the same for an opening and edging of silk	50 denarii.
To the same for an opening and edging with stuff made of a mixed tissue of silk and flax	30 denarii.

Mrs. Lynn Linton, the accomplished novelist and authoress, who has written three charming and learned papers on silk in the "Queen" for the month of January, which I cordially recommend you all to read, and from which I have gathered the above historical particulars, thus winds up her first paper:—"Silk, then, was both known and used in the later days of Rome. It was the sign of corruption and effeminacy. It had to fight its way into general acceptance against all the forces of simplicity and virtue which were associated with wool and linen arrayed against silk. But the wheel rolled on, and the prohibitions and prejudices were finally removed, till now the very beggar-woman at your door has something of silk about her, and the material which an emperor refused to his empress, the vagrant and the pauper toss on to the dust-heap when they have done with it."

Coming down to mediæval times, we find Constantinople the chief seat of the European silk trade. In Justinian's time it had got no further westward. He limited the price of silk to £4 15s. 9d. per lb., and when dyed imperial purple its price was quadrupled. The Christian clergy gradually became captivated by its beauty, and blessing superseded anathema. Abbot Benedict, in 685, went to Rome to buy silks. St. Cuthbert, we know, was buried in the 7th century at Landisfarne Island, and was in the 13th century disinterred and re-buried at Durham Cathedral, first being re-robed in silks which may be seen now in that Cathedral, and reproductions of which, by the kindness of Canon Greenwell, I have been

able to print and bring here. And so on up to to-day, the Church has become the nursing mother of all that is beautiful in design, and colouring, and in texture of silk, and so it should be to give God our best.

Let us turn now to the silk of the present day. I will not weary you with the history of the introduction of silk manufacture into England. I have here a specimen of blue and red silk from a deed of the time of Richard I., A.D. 1190, which was used as an attachment to a large wax seal. Both the silk and the dyes are interesting. The blue is woad, the ancient English blue dye. The poet Dyer, who wrote in the early part of the last century, thus mentions it :—

> "Our valleys yield not, or but sparing yield
> The dyers' gay materials. Only weld,
> Or root of madder, here, or purple woad,
> By which our naked ancestors obscur'd
> Their hardy limbs, inwrought with mystic forms
> Like Egypt's obelisks."

The red is Kermes, an ancient colour produced by the oak-feeding insect, Coccus quercus. It was generally used for this purpose in those days in Europe before the introductionof Cochineal from Mexico into Spain by the Spaniards in 1543, and practised at Bow, where it became celebrated as the Bow dye. Its introucdtion into Italy was not until 1548, five years later. It was soon

the downfall of Kermes, which, although generally now disused, is still found and used in Tripoliza in Greece. Pardon this digression, but it is difficult for a dyer to disassociate dyeing from silk. From the time when the persecuted Hugenots brought to us themselves and their trades at the time of the persecution of the protestants in Flanders and France in the latter half of the sixteenth century, and again in 1685, at the revocation of the Edict of Nantes, we have been a silk manufacturing country. These epochs gave us a silk industry, as well as many other arts and crafts. The old rhyme sings :—

> "Hops, Reformation, bays, and beer
> Came into England all in a year."

Very varying have been the vicissitudes of our silk industry. Spitalfields, almost the oldest centre, still maintains its artistic prestige as these gorgeous and artistic surroundings show. My friends, Messrs. Warner and Sons, have to-day done the Field Club a signal service in lending these beautiful examples of brocades, damasks and brocatelles, unrivalled for texture, pattern and colour-

ing by any silks of the kind I have ever seen in France, and my opportunities of judging, having served on the Silk Juries of the great Paris Exhibitions of 1878 and 1889, have not been small. The same must be said for these splendid brocades and figured stuffs for Church furniture and dress purposes, made and kindly lent to us by my artistic friend Mr. George Bermingham, Silk Manufacturer, of Leek. These will show that England can and does manufacture silk equal for every possible requirement, and emphatically bears protest against the false assertions of the middleman that good silks can only be had from France.

One of my objects in choosing this subject, has been the hope of enlisting your sympathy and patriotism, the ladies particularly, in favour of British silks, and to ask you to help the efforts of the Silk Association of Great Britain and Ireland (of which I have the honour of being President), and of the Ladies National Silk Association, presided over by H.R.H. the Duchess of Teck, with Lady Egerton of Tatton, as Honorary Secretary, whose object is to solicit the membership of all ladies who will agree only to ask for British silks when they want to buy silk of any kind; still not pledging themselves to buy such silk if they do not find it as cheap, as durable, and as artistic, as foreign silk.

This Ladies Association is spreading rapidly; already the looms of Spitalfields and Macclesfield are again busy, and we hope for a great revival in the other time-honoured centres. The looms of Spitalfields and Patricroft were merry with the sound of shuttles only a few sad months ago, when the Duchess of Teck gave orders that all silks for the Royal wedding should be home made and not foreign. Here is a specimen of it with May blossoms woven in silver. Alas! that the looms should have been stopped in the middle of their work and their shuttles made to weave for woe instead of bridal joy!

In conclusion, I am reminded of the Ancient Grecian story of Minerva and Arachne, which tells that in the days when purple was rare and highly appraised; the dye very hard withal to extract from its tiny gland in the shelly Murex, which but hardly yielded its tinctured drop of costly colour, there lived by Lydia's shores, Idmon the purple dyer, in his craft renowned for skill. He had a daughter whose name was Arachne, famed for her art in spinning and broidery, but who acknowledged not her obligations to and dependency upon, great Jove's daughter, Minerva; (in the Greek mythology Minerva was called Pallas Athene, the goddess of the liberal arts); but disdainfully challenged her to a contention of

skill. They met, the story tells, to weave their separate thoughts with fixed warp and bobbins of weft, each in her own loom. It was a pleasure to observe Arachne winding the wool and curling and twisting it into fine threads, ready to contend with Minerva in the trial of her skill in weaving. Each put her loom in a separate place and stretched the fine threads thereon. The combatants hastened to their work having first girded their robes about their bosoms. They ply their deft hands, and their facile brains encourage the work. Minerva weaves the Castle of the Cecrops standing on the rock of Mars and of the quarrel concerning the name of the country. Twelve immortals are seated on their thrones in austere solemnity with Jupiter in their midst. The individuality of each god is delineated and Jupiter is rendered in regal splendour. Neptune the sea god alone is standing, and with his trident he strikes the unhewn rock from which the salt-water gushes forth. Minerva is shown furnished with the defending Ægis, and having on her head a helmet and in her hand a pointed lance. At the place where the lance has pierced the ground a green olive tree bearing berries is sprouting. The work is surrounded by a garland. The gods look at it with astonishment.

But Arachne wove the story of Europa carried away by the bull. The latter seems to be really living and the sea to be heaving. In addition Arachne wove Asteria seized by the flying eagle, the loves of Leda and the Swan, and of Antiope and the false Satyr. She wove the scenes of Jupiter as Amphitrion wooing Alkmene; Mnemosin's seduction by Jupiter in the guise of a herdsman, Aegina and Jupiter in the fire; and lastly Danæ tempted by gold and Proserpine by a Dragon. An ivy garland went round the border with flowers interwoven. The nymphs said about the woven work of art that neither Minerva nor jealous mind could find fault with the work; Arachne's fertile skill brought her to Minerva's level, but the latter's work was inspired by a nobler mind. Notwithstanding Dante meeting her in Purgatory says:

> "Although in colours variegated more,
> Nor Turks nor Tartars e'er on cloth of State,
> With interchangeable embroidery wove,
> Nor spread Arachne o'er her curious loom."

Minerva viewed Arachne's work, and incensed, rent it into pieces, chastising its founder with her broiding bobbins, whereat Arachne, so keenly feeling her degradation, desired not to outlive it, took a rope to a neighbouring tree, and hasted to end her troubled life. As she in mid-air hung, Minerva with her wand changed her into a spider (whence the Arachnida of our Entomology) her rope into

a web, and left her in perpetua to web, or as we now say, to weave. Dante describing his visit to Inferno met her in the lowest woe, and writes :—

> "O fond Arachne! thee I only saw
> Half spider now in anguish crawling up
> The unfinished web thou weaved'st to thy bane."

From whatever causes our beautiful silk industry has met with Arachne's fate, I feel sure that our new awakening to the necessity of technical instruction and greater efficiency shall one day restore our Arachne to her loom and real shape, and begin again to twist and weave that charming thread of which some one has aptly said that silk is to the fibres what gold is amongst metals, and the diamond amongst jewels, and that we shall hope to see our country by art creative power and thoughtful skill as lastingly famous as were Moir and Mohair from the Moors, Cambric from Cambay, Bokhara for its buckram, Renne for its cloth of Rayne, Cyprus for its cypresse, Tucker-street, Bristol, for its tuck, the Saracens for sarsenets, Calicut for its calicoes, Tartarium cloths from Tartary, so skilfully woven that

> "No painter's brush could match them hanging in
> Broad bands of fine Tartarians."

so Chaucer wrote. Fostat for its fustians, Arras for its arras, Nankin for its nankeen, Gaza for its gauze, Cordova for its cordwain, Baiae for its baize, Friesland for its frieze, Jean for its jean, Damietta for its dimity, Tarsus for its tabriz, Drogheda for its druggets, Old Worsted (in Norfolk) for its worsted, Kersey for its kerseymere, Linsey for its linsey-wolsley, Guninghamp for its gingham, Avignon for its papal cloth or poplin, five hundred years ago, Masul for its muslin, Damascus for its damask. Of ancient places, many still famous, as Cashmere for its shawls, and formerly for its kerseymere, Coptic Akhmim for its tunics and cloths, Dacca for its floss and finest of muslins.

Let us augur that this beautiful but almost lost industry may be soon regained, and that the £11,000,000 sterling we have been for the last 25 years paying the foreigner for our manufactured silks, shall be paid to a future and successful British industry, and that if the ladies will only come to our aid and prefer British art in silk, we shall be able to say that "they shall walk in silk attire and siller hae to spare."

LIST OF THE LANTERN SLIDES.

1. Cotton, showing its flat and twisted fibre of cellulose.
2. Linen Fibres, the elementary fibres of flax (Linum usitatissimum) are cells of pellucid membranes joined end to end with can-like joints, between which form thickened vessels with fibrous matter; along with these are seen the woody fibre or tissue, consisting of "elongated cells or tubes, with tapering extremities which overlap each other, and by their union longitudinally form the fibres called hemp and flax."
3. Typical Woollen Fibre.
4. Spider Silk.
5. Silk of Saturnia carpini.
6. Silk Bave and Brin in contact and separated, also showing sections.
7. Bave of Bengal silk, showing loops as seriposited, demonstrating that the fibre is regular.
8. Rough places in the silk fibre formerly supposed to be inherent, shown under the microscope to be merely unresolved loops in rabble, caused by imperfect reeling.
9. Silk Fibres, Bave and Brin shown to be perfectly smooth, although somewhat irregular in thickness.
10. Larva of Bombyx Mori feeding on the mulberry leaf.
11. Bengal cocoons of Bombyx fortunatus.
12. Avenues of twigs upon which the larva of Bombyx Mori form their cocoons in Italy.
13. Interior of magnanerie or cocoon sorting room.
14. Oven or chamber in which the chrysalides are killed to prevent them escaping from the cocoons.
15. A Native Indian Wheel for silk reeling.
16. Improved European Machinery for cocoon-reeling with the Tavelette Keller, and girl reeling.
17. Silk Moths of the Bombyx Mori.
18. Larva of Antheræa mylitta, or Tussur Silkworm.
19. Cocoons of the Tussur Silkworm.
20. Cocoons of the Tussur Silkworm attached to branches.
21. Indian Tussur Silk Bave, showing fibrillæ and sections.
22. Indian Tussur Silk Brin, showing fibrillæ separated.

23. Indian Tussur Silk Bave, showing foldings of the fibres as laid by the silkworm.
24. Indian Tussur Silk Moth, Antheraea mylitta, male.
25. Indian Tussur Silk Moth, Antheraea mylitta, female.
26. Cocoons of Philosamia ricini, or Eria Silkworm.
27. Fibres from cocoons of ditto.
28. Moth of Philosamia ricini, or Eria Silk moth.
29. Antheræopsis assama, or Muga Cocoons.
30. Moth of Antheræopsis assama, or Muga Moth, male
31. Cocoon of Rinacula zulica.
32. Moth of ditto.
33. Cocoon of Actias selene.
34. Moth of Actias selene, male.
35. Moth of Actias selene, female.
36. Moth of Actias leto, male.
37. Moth of Actias leto, female.
38. Cocoon of the Atlas Moth, Attacus Atlas.
39. Attacus Atlas Moth, female, the largest moth known.
40. Moths of Bombyx Mori, for size comparison with Attacus Atlas.
41. Scales from the moth's wings magnified.
42. A single scale from the moth's wings highly magnified.
43. Silk Weaving at Agra.
44. Jewelled and Spangled Cloth Embroiderers at work, Delhi.
45. Old Italian Embroidery.
46. Silk Embroidered Chasuble.
47. Old Italian Embroidery.

LIST OF SILK-PRODUCING LEPIDOPTERA,

BROUGHT UP

TO THE PRESENT DATE.

Those marked thus *a* are in my collection in the imago state. Of those marked *aa* I have both imago and cocoon. Of those marked thus † I have the larva, cocoon, and imago. Of those marked thus †† I have the imago, larva, and chrysalis. Of those marked thus ‡ I have the cocoon only. Those not marked I do not possess in any stage, and I shall be glad to receive larvæ and mothes but more particularly the cocoons of all or any of these species to assist me in the investigation of the physical properties and structure of the silk fibres of the Heterocera, a work in which I have for some time been engaged.

CLASSIFICATION.

ANIMALIA.

SERIES 2	Metazoa (Huxley)
SUB-SERIES 2	Deuterostomata *a Schizocœla*
SUB-KINGDOM 5	Anthropoda *Articulata*
CLASS 4	Insecta
ORDER 7	Lepidoptera *Glossata*
SUB-ORDER	Heterocera (Moths)
Group	Bombycina

FAMILY.	GENUS AND SPECIES.	LOCALITY.
1 Sesiidae	Trochilium apiforme	Europe †
2 Hetergynidae	Hetergynis penella	„ *aa*
„	„ paradoxa	„ *a*
3 Zygaenidae	Ino chloros	„ *a*
„	„ globulariae	Britain *a*
„	„ statices	„ *a*
„	„ geryon	„ *a*
„	Zygaena pilosellae	„ *a*
„	„ exulans	„ *a*
„	„ meliloti	„ *a*
„	„ trifolii	„ *a*
„	„ lonicerae	„
„	„ filipendulae	„ *aa*
„	„ carniolica	Europe *aa*
„	„ fausta	„ *aa*
4 Nycteolidae	Sarrothripa undulana	„ *aa*
„	Erias vernana	„ *a*
„	„ clorana	Britain *a*
„	Hylophila prasinana	„ *aa*
„	„ bicolorana	„ *a*
5 Lithosidae	Nola cucullatella	„ *a*
„	„ togatulalis	„ ‡
„	„ strigula	„ *a*
„	„ confusalis	„ *a*
„	„ albula	„ *a*
„	„ centonalis	„ *a*
„	Nudaria murina	„ *aa*
„	Setina irrorella	„ *a*
„	Lithosia mesomella	„ *a*
„	„ muscerda	„ *a*
„	„ griseola	„ *a*
„	„ stramineola	„ *a*
„	„ deplana	„ *a*
„	„ lurideola	„ *a*
„	„ complana	„ *a*
„	„ caniola	„ *a*
„	„ pygmaeola	„ *a*
„	„ sororcula	„ *aa*
„	„ quadra	„ *a*
„	Gnophria rubricollis	„ *a*
6 Arctiidae	Emydia striata	„ *a*
„	„ cribrum	„ *a*

FAMILY.	GENUS AND SPECIES.	LOCALITY.	
6 Arctiidae	Nemeophila russula	Jersey	*a*
,,	,, plantaginis	,,	*a*
,,	Callimorpha dominula	Britain	*a*
,,	,, hera	,,	*a*
,,	Pleretes matronula	Europe	
,,	Arctia caja	Jersey	*aa*
,,	,, flavia	Europe	
,,	,, villica	Jersey	*a*
,,	,, purpurata	Europe	†
,,	,, hebe	,,	††
,,	,, aulica	,,	††
,,	,, casta	,,	
,,	Ocnogyna parasita	,,	†
,,	Spilosoma fulginosa	Jersey	*a*
,,	,, sordida	Alps	
,,	,, mendica	Jersey	*a*
,,	,, lubricipeda	,,	*a*
,,	,, zatima	Europe	*a*
,,	,, menthrasti	,,	*a*
,,	,, urticae	,,	*a*
7 Hepialidae	Hepialus virescens	New Zealand	
8 Cossidae	Cossus cossus	Europe	
,,	,, terebra	,,	
9 Cochliopodae	Heterogenea limacodes	Britain	*a*
,,	,, asella	,,	*a*
10 Psychidae	Psyche cocoons	Senegal	
,,	,, cocoons found in the tea plant	India	
,,	,, cocoons	Natal	
,,	,, cocoons	,,	
,,	,, cocoons	Dominica	
,,	,, unicolor	Europe	†
,,	,, villosella	,,	††
,,	,, ecksteini	,,	††
,,	,, zelleri	,,	††
,,	,, plumifera	,,	††
,,	,, hirsustella	,,	††
,,	,, cocoons	Trinidad	
,,	Thyridopteryx ephemeraeformi	North America	
,,	Euneta japonica	India	
,,	Epichnopteryx helicinella	Europe	

FAMILY.	GENUS AND SPECIES.	LOCALITY.
11 Liparidae	Orgyia gonostigma	Britain
,,	,, antiqua	,,
,,	,, ericae	Europe †
,,	,, josephina	Algeria *a*
,,	,, leucostigma	North America
,,	Dasychira confusa	Amur
,,	,, selenitica	Europe
,,	,, pudibunda	Britain
,,	,, fascelina	,,
,,	,, abietis	Europe
,,	Laelia coenosa	Britain
,,	Laria L nigrum	Europe
,,	Leucoma salicis	Britain
,,	Porthesia chrysorrhœa	,, *a*
,,	,, auriflua	,, *a*
,,	Psilura monacha	,, *a*
,,	Ocneria dispar	,, *a*
,,	Darala ocellata	Indo-Australasia *a*
,,	Murlida mutans	,, *a*
,,	,, citrina	,, *a*
,,	,, undata	,, *a*
,,	Calepteryx collesi	,, *a*
12 Bombycidae	Bombyx mori	Italy, green cocoons †
,,	,,	Italy, yellow cocoons *aa*
,,	,,	Italy, white cocoons *aa*
,,	,,	Japan, white cocoons ‡
,,	,,	China, white cocoons ‡
,,	,,	French, white & yellow cocoons ‡
,,	,,	Broussa, white & yellow cocoons ‡
,,	,,	Cyprus, large white cocoons ‡
,,	,,	Cashmere cocoons ‡
,,	,,	Burma cocoons ‡
,,	,,	Ceylon cocoons ‡

FAMILY.	GENUS AND SPECIES.	LOCALITY.
12 Bombycidae	Bombyx mori	Kashmir cocoons ‡
,,	,,	Saharumpur ,, ‡
,,	,,	Cawnpur ,, ‡
,,	,,	Lahore ,, ‡
,,	,,	Persia ,, ‡
,,	,, fortunatis	Bengal *aa*
,,	,, crœsi	,, *aa*
,,	,, textor	India *aa*
,,	,, meridionalis	,, *aa*
,,	,, arracanensis	Arracan and Burmah *aa*
,,	,, sinensis	India *aa*
,,	,, rhadama	Madagascar *aa*
,,	,, borocera	North America
,,	,, crataegi	Britain *aa*
,,	,, populi	,, *aa*
,,	,, francomcia	Europe *aa*
,,	,, alpicola	,, *a*
,,	,, castrensis	Britain †
,,	,, neustria	,, †
,,	,, americana	North America *a*
,,	,, innocens	,, ,, *a*
,,	,, henckei	Rossmer *a*
,,	,, lanestris	Britain †
,,	,, catax	Europe †
,,	,, rimicola	,, †
,,	,, trifolii	Britain †
,,	,, abserrula	Spain †
,,	,, quercus	Britain *a*
,,	,, rubi	Britain *a*
,,	,, ursula	Africa *a*
,,	,, ilicis	Europe
,,	,, neogene	,,
,,	,, loti	,,
,,	,, vandalicia	,,
,,	,, fasciatella	,,
,,	,, affinis	Chota Nagpur
,,	,, annulipes	Africa
,,	,, bauhinia	,,
,,	,, diego	,,
,,	,, fleurioti	,,
,,	,, panda	,,

FAMILY.	GENUS AND SPECIES.	LOCALITY.
12 Bombycidae	Chondrostega pastrana	Europe
,,	Crateronyx dumi	,, *a*
,,	Lasiocampa potatoria	Britain †
,,	,, albomaculata	Amoor *a*
,,	,, laeta	,, *a*
,,	,, pruni	,, *aa*
,,	,, sumatrensis	Indo-Australasia *a*
,,	,, quercifolia	Britain †
,,	,, populifolia	Central Europe †
,,	,, tremulifolia	Europe *a*
,,	,, ilicifolia	Britain *a*
,,	,, new species	Indo-Australasia *a*
,,	,, suberifolia	France & Spain *a*
,,	,, pardale	Indo-Australasia *a*
,,	,, lunigera	South Germany *a*
,,	,, ablobulina	Saxony *a*
,,	,, pini	Central Europe *a*
,,	,, bufo	Europe & Siberia †
,,	,, otus	,, ,, †
,,	,, dieckmanni	Siberia *a*
,,	,, lineosa	Europe
,,	,, femorata	,,
,,	Megasoma repanda	,, *a*
,,	Theophila huttoni	India *aa*
,,	,, mandarina	China
,,	,, sherwilli	S. E. Himalayas
,,	,, bengalensis	Lower Bengal
,,	Ocinara religiosa	Assam & Cachar
,,	,, comma	Doon Mussoorie
,,	,, livida	Mussoorie
,,	Trabala vishnu	India
,,	,, villosipes	,,
,,	Trilochana varians	Calcutta
,,	Borocera postica	Madagascar
,,	Eucheira socialis	Mexico
,,	Demas coryla	Britain *a*
,,	Eriogaster proximo	South America *a*
,,	,, hirtina	,, ,, *a*
,,	Hylesia canitiae	Honduras †
,,	Titya undulosa	South America *a*
,,	Macromphalia chilensis	,, ,, *a*
,,	Boroceros postica	South Africa †

FAMILY.	GENUS AND SPECIES.	LOCALITY.
12 Bombycidae	Lebedaa pityocampacrameis	Africa *a*
,,	Gangerarides rosea	Indo-Australasia *a*
,,	Drymonia senatoria	North America *a*
,,	,, alba	,, ,, *a*
,,	Nemeresa trimacula	South America *a*
,,	Hydrias nacens	,, ,, *a*
,,	Gonometa postica	Africa *a*
,,	Palustra burmeisteri	South America *aa*
13 Endromidae	Endromis versicolora	,, ,, †
14 Saturnidae	Attacus atlas	India †
,,	,, cynthia	,, †
,,	,, ricini	,, *aa*
,,	,, insularis	,, *a*
,,	,, bolivar	Trinidad
,,	,, hesperus	Guiana *a*
,,	,, aurota	South America *aa*
,,	,, jacobae	,, ,, *a*
,,	,, maurus	,, ,, *a*
,,	,, orizaba	Mexico *a*
,,	,, speculum	South America *aa*
,,	,, sp.	Demerara (G. T. Hawtayne, Esq.) *aa*
,,	,, arethusa	South America *a*
,,	,, canningi	Hindostan
,,	,, edwardsia	Sikkim
,,	,, guerini	India
,,	,, lunula	Ceylon
,,	,, obscurus	Cachar
,,	,, splendidus	Africa
,,	,, jorulla	Mexico
,,	,, crameri	Amboina
,,	,, andromeda	Valdivia
,,	,, cinerascens	,,
,,	,, larquinii	Lozou
,,	,, vesta	Hindostan
,,	,, walkeri	Ning-po
,,	,, chapata	Mexico
,,	,, betis	Brazil
,,	,, aricia	Santa Fe de Bogota
,,	,, ethra	Caraccas
,,	,, zacatica	Bogota
,,	,, vacuna	Ashantee

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Attacus mythimna	Zululand
,,	,, baumhiria	Senegal
,,	,, irius	East Indies
,,	,, saturnus	,, ,,
,,	,, sylhetica	Sylhet
,,	,, splendens	Bogata
,,	,, laventera	Mexico
,,	,, gelleta	,,
,,	Platysamia cecropia	North America *aa*
,,	,, columbia	Columbia *a*
,,	,, ceonothi	North America *a*
,,	,, calleta	South America *a*
,,	,, gloveri	North America *a*
,,	Callosamia angulifera	,, ,, *aa*
,,	Samia promethea	,, ,, *aa*
,,	Telea polyphemus	,, ,, *aa*
,,	Bunaea alcinoe	Africa *a*
,,	,, caffaria	South Africa *a*
,,	,, tyrrhena	Zululand
,,	,, alinda	Sierra Leone
,,	,, phaedusa	West Africa
,,	,, nictitans	Tropical Africa
,,	,, angusana	Port Natal
,,	,, alopia	South Africa
,,	,, farda	Port Natal
,,	,, acetes	Cape of Palms
,,	,, mopsa	W. Africa
,,	,, dorcas	,,
,,	,, epimethea	Ashanti
,,	,, magniferae	Madagascar
,,	,, zambesina	Zambesi region
,,	Copaxa decresens	South America *a*
,,	,, canella	Brazil
,,	,, satellitiae	Bogota
,,	,, expandens	Venezuela
,,	,, plenkeri	Mexico
,,	Syntherata janetta	Indo-Australasia *aa*
,,	Sagana sapatoza	Santa Fe de Bogota
,,	,, punctigera	,, ,,
,,	Thyelia nyctelops	Caffraria
,,	,, bunaea	

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Antheraea arata	Ashanti
,,	,, cytherea	W. & S. Africa
,,	,, hersilia	Congo
,,	,, tyrrhea	S. Africa
,,	,, dione	Africa
,,	,, suraka	Madagascar
,,	,, larissa	Java
,,	,, jana	Java
,,	,, astrocephala	Australia
,,	,, rumphi	Amboina
,,	,, semper	Luzon
,,	,, purpurascens	N. Australia
,,	,, disjuncta	Moreton Bay
,,	,, pristina	New Guinea
,,	,, walbergi	S. Africa
,,	,, helena	Tasmania
,,	,, andamani	S. Andamans
,,	,, confuci	Shanghai
,,	,, mezankooria	Assam
,,	,, nebulosa	Singbhoom
,,	,, perrotteti	Pondicherry
,,	,, assama	Assam *aa*
,,	,, mylitta	India *aa*
,,	,, frithii	Sikhim *a*
,,	,, helferi	,, *a*
,,	,, menippe	Africa *a*
,,	,, roylei	India *aa*
,,	,, pernyi	China *aa*
,,	,, feltoni	,, *a*
,,	,, belina	Indo-Australasia *a*
,,	,, yama-mai	Japan *aa*
,,	,, eucalypti	Indo-Australasia *a*
,,	,, simplex	Africa *a*
,,	Caligula simla	India *aa*
,,	,, japonica	Japan
,,	,, cachara	Cachar
,,	,, thibeta	Thibet
,,	Gyanisia isis	Africa *a*
,,	Neoris huttoni	N.W. Himalayas *a*
,,	,, shadulla	Yarkund
,,	,, stolughana	Ladak India
,,	Loepa katinka	India †

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Leopa miranda	India *aa*
,,	,, sikkima	Sylhet
,,	,, sivalica	Mussoore
,,	Rhodia newera	Sikkim †
,,	Hyperchiria io	NorthAmerica *aa*
,,	,, pamina	South America *a*
,,	,, metzlii	,, ,, *a*
,,	,, liberia	,, ,, *a*
,,	,, orodes	,, ,, *a*
,,	,, scapularis	,, ,, *a*
,,	,, coresus	,, ,, *a*
,,	,, viridescens	,, ,, *a*
,,	,, euryopa	,, ,, *a*
,,	,, illustris	,, ,, *a*
,,	,, complicata	,, ,, *a*
,,	,, salmonia	,, ,, *a*
,,	,, beskei	,, ,, *a*
,,	,, nyctimena	,, ,, *a*
,,	,, aspera	,, ,, *a*
,,	,, myops	,, ,,
,,	,, braziliensis	Brazil
,,	,, erythrina	Valdivia
,,	,, larra	Rio Janeiro
,,	,, junonia	Bagota
,,	,, convergens	Rio Janeiro
,,	,, beckeri	S. America
,,	,, oblonga	Santa Fe de Bogota
,,	,, jucunda	Surinum
,,	,, griseoflava	Chili
,,	,, tridens	Brazil
,,	,, basalis	Venezuela
,,	,, melanops	Brazil
,,	,, incarnata	Begota
,,	,, cruenta	Brazil
,,	,, approximata	Bogota
,,	,, memusea	Brazil
,,	,, acutissima	Mexico
,,	,, cinerea	Brazil
,,	,, megalops	Bogota
,,	,, pyrrhomelas	Santa Fe de Bogota
,,	,, combusta	
,,	,, inornata	Brazil

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Hyperchiria luteata	
,,	,, janeira	Rio Janeiro
,,	,, hebe	Oajaca Mexico
,,	,, abas	Surinum
,,	,, iris	Oajara Mexico
,,	,, continua	Mexico
,,	,, arminia	Surinum
,,	,, inficita	Ega
,,	,, incisa	Brazil
,,	,, saturniata	Bogota
,,	,, nausica	Brazil
,,	,, erythrops	Coquimbo
,,	,, metapyrrha	Rio Janeira
,,	,, approximans	,, ,,
,,	,, subcana	,, ,,
,,	,, schaussi	N. America
,,	,, varia	,, ,,
,,	,, ruberescens	Venezuela
,,	,, saturata	Mexico
,,	,, janus	Surinum
,,	,, fusca	S. America
,,	,, bilinea	Para, Brazil
,,	,, armida	Surinum
,,	,, metea	Bolivia
,,	Brahmaea lunulata ledereri	Europe *a*
,,	,, certhia	Sylhet
,,	,, lucina	Sierra Leone
,,	,, undulata	Ning-po
,,	Saturnia boisduvali	Europe *a*
,,	,, atlantica	,, ‡
,,	,, pyri	South Europe *a*
,,	,, schenkii	,, ,, *a*
,,	,, anna	Sikkim
,,	,, carpini	
	,, lindia	Sikkim
,,	,, pyretorum	Siberia *a*
,,	,, spini	S. E. Europe and
,,		W. Asia *a*
,,	,, grotei	Darjeeling
,,	,, galbina	South America *a*
,,	,, jankowskii	Europe *a*

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Saturnia diana	Europe and Siberia *aa*
	„ mendocina	North America *a*
„	„ caecigena	Europe & Western Asia *aa*
„		
„	„ fuscicolor	Africa
„	„ nenia	Congo
„	„ said	Bagamayo
„	„ cajana	Africa
„	„ auricolor	„
„	„ wallengrenii	Caffraria
„	„ usta	
„	„ attacus	S. Africa
„	„ hoegii	S. America
„	„ lucina	Sierra Leone
„	„ melvilla	Melville Island
„	„ cidosa	Sikkim
„	Actias isabella	Spain *a*
„	„ artemis	Siberia *a*
„	„ luna	North America *aa*
„	„ selene	India *aa*
„	„ ignescens	Andaman Isles
„	„ leto	East Indies
„	„ manas	Sylhet
„	„ sinensis	North China
„	„ dictynna	
„	„ mimosa	S. Africa
	„ rosenbergii	Amboina
„	Aglia tau	Central Europe & Northern Asia *a*
„		
„	Rinaca zuleika	Sylhet
„	Salassa lola	„
„	Endaemonia semiramis	Honduras
„	„ argus	Ashanti
„	Perisomena semicaecia	Port Natal
„	Giacla	
„	Polysthana rubrescens	South America *aa*
„	„ andromeda	„ „ *a*
„	Hemileuca maja	North America *a*
„	„ nevadensis	„ „ *a*
„	„ pica	United States
„	Pseudohazis venosa	Carraccas

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Pseudohazis eglanteria	California
,,	Aphelia apollinaris	Port Natal
,,	Rhescyhtis hyppodamia	Rio Janeiro
,,	,, armida	S. America
,,	,, hercules	Rio Janeiro
,,	,, aspasia	S. America
,,	,, sylla	Surinum
,,	,, meander	Brazil
,,	,, xanthopus	,,
,,	,, latifascia	
,,	,, kadenii	
,,	,, erythrina	South America *a*
,,	,, pandora	,, ,, *a*
,,	Eudelia rufescens	,, ,, *a*
,,	Urota sinope	Africa *a*
,,	Dysdaemonia glaucescens	Brazil
,,	,, boreas	West Indies
,,	Henucha smilax	Port Natal
,,	,, grimmia	S. Africa
,,	,, delegarguei	Port Natal
,,	Heliconisa impara	Spirito Sancto
,,	,, pagenstecheri	
,,	Micrattacus nanus	Rio Janeiro
,,	,, dissimilis	South America *a*
,,	Mimallo despecta	South America *a*
,,	,, amilio	Brazil
,,	,, cicinnus	Chili
,,	,, arthane	Conception
,,	,, plana	Brazil
,,	,, verago	Surinum
,,	,, saturata	Rio Janeiro
,,	,, trilunula	Brazil
,,	,, plagiata	,,
,,	Microgone agathylla	Congo
,,	Cyrtogone naenia	S. Africa
,,	,, herilla	Africa *a*
,,	Molippa sabina	South America *a*
,,	Coloradia venata	,, ,, *a*
,,	Dirphia tarquinia	Cayenne *aa*
,,	,, vulpina	South America *a*
,,	,, cinnamonea	,, ,, *a*
,,	,, marginata	,, ,, *a*

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Dirphia glauca	South America *a*
,,	,, speciosa	,, ,, *aa*
,,	,, calchas	Rio Janeiro
,,	,, triangulum	,, ,,
,,	,, arasia	Surinum
,,	,, avia	,,
,,	,, polybia	,,
,,	,, ursina	Bolivia
,,	,, concolor	Venezuela
,,	,, varia	Bolivia
,,	,, eumenides	Surinum
,,	,, obtusa	Para
,,	,, rustica	Surinum
,,	,, nubila	,,
,,	,, agis	Brazil
,,	,, pulchricornis	Venezuela
,,	,, semirosea	Mexico
,,	,, somniculosa	Brazil
,,	,, litura	Santa Fe de Bogota
,,	,, hircia	Surinum
,,	,, amalia	,,
,,	,, plana	,,
,,	,, angulifera	Peru
,,	,, multicolor	Rio janeiro
,,	,, rosacordis	,, ,,
,,	,, satellitia	,, ,,
,,	,, purpurascens	,, ,,
,,	,, andulosa	,, ,,
,,	,, vagans	Brazil
,,	,, aconyta	Bengal, Coromandel
,,	,, canitia	Surinum
,,	,, phadima	,,
,,	,, metabus	,,
,,	,, obsoleta	,,
,,	,, rivulosa	,,
,,	,, cognata	Valdivia
,,	,, maginata	,,
,,	,, melanostigma	Brazil
,,	,, maginella	Bogota
,,	,, quadricolor	Ega
,,	,, pallida	Bogota

FAMILY.	GENUS AND SPECIES.	LOCALITY.
14 Saturnidae	Caloptera ocellata	Crete
,,	Ceratocampa regalia	South America *a*
,,	,, imperialis	North America *a*
,,	Rhodia newera	India
	DOUBTFUL SILK PRODUCERS IN THIS FAMILY.	
,,	Eacles or Ceratocampa	
,,	,, princeps	Brazil
,,	,, laocoon	Georgia
,,	,, ducalis	Rio Janeiro
,,	,, magnificas	Para
,,	,, pharonea	Brazil
,,	,, cacicus	Rio Janeiro
,,	,, principalis	Brazil
	SILK PRODUCERS.	
15 Drepanulidae	Drepana lacerta	Britain *aa*
,,	,, harpagula	,, *a*
,,	,, falcataria	,, *aa*
,,	,, binaria	,, *a*
,,	,, cultraria	,, *a*
,,	Cilix glaucata	Europe *a*
,,	Cricula trifenestrata	India †
,,	Lonomoia albigutta	South America *a*
16 Notodontidae	Harpyia furcula	Britain ‡
,,	,, bifida	,, ‡
,,	,, vinula	,, ‡
,,	Stauropus fagi	,, *a*
,,	Notodonta tremula	,,
,,	,, dictaeoides	,, *a*
,,	,, ziczac	,, *a*
,,	,, tritophus	,, *aa*
,,	,, trepida	Europe *aa*
,,	,, torva	,, *aa*
,,	,, dromedarius	Britain *a*
,,	,, chaonia	,, *a*
,,	,, dodonea	,, *aa*
,,	,, bicolora	,, *a*
,,	Cophopteryx carmelita	,, *a*

FAMILY	GENUS AND SPECIES.	LOCALITY.	
16 Notodontidae	Cophopteryx camelina	Britain	*a*
,,	,, cucullina	,,	*a*
,,	Uropus ulmi	,,	††
,,	Asteroscopus sphinx	,,	*a*
,,	Pterostoma palpina	,,	*a*
,,	,, nubeculosus	,,	*a*
,,	Gluphisia crenata	,,	*a*
,,	Ptliophora plumigera	,,	*a*
,,	Pygeara anastomosis	,,	††
,,	,, curtula	,,	
,,	,, anachoreta	,,	
,,	,, pygra	,,	
,,	Heterocampa subrotata	North America	*a*
,,	,, quadrata	South America	*a*
,,	,, amazonic	,, ,,	*a*
,,	Edema albifrons	North America	*a*
,,	Cnethocampa processionea	South & Central Europe	*a*
,,	,, pityocampa	North Germany	*a*
,,	,, pinivora	Europe	*aa*
,,	,, herculeana	,,	*a*
17 Cymatophoridae	Thyatira batis	Europe	†
,,	Asphalia ridens	,,	
18 Noctuæ	Loma orion	Britain	
,,	Dipthera ludifica	Europe	*aa*
,,	Acronycta auricoma	Britain	*a*
,,	,, menyanthidis	,,	*a*
,,	Simyra venosa	,,	†
,,	Diloba caeruleocephala	Britain	
,,	Arsilonche albovenosa	,,	
,,	Clidia geographica	,,	†
,,	Polia canescens	,,	†
,,	Panthea coenobita	,,	†
,,	Memestra persicariae	Saxony	
,,	Valeria oleagina	Europe	†
,,	Hadnea porphyrea	,,	†
,,	Eriopus latreilli	,,	*aa*
,,	Trachea atriplicis	,,	*a*
,,	Euplexia lucipara	,,	*aa*
,,	Dicycla oo	,,	††
,,	Cucullia verbasci	,,	
,,	,, scrophulariae	Britain	*a*

FAMILY.	GENUS AND SPECIES.	LOCALITY.	
18 Noctuœ	Cucullia lactucae	Europe	*a*
,,	,, chamomillae	,,	
,,	,, tanecti	,,	
,,	,, argentea	,,	†
,,	Eurhipia adulatrix	,,	†
,,	Plusia triplasia	,,	†
,,	,, moneta	,,	*aa*
,,	,, festucae	,,	†
,,	Aedia funesta	,,	†
,,	Thalpohares dardouini	,,	†
,,	,, rosea	,,	
,,	Erastria venustula	,,	*aa*
,,	Catocala sponsa	Britain	*a*
,,	,, promissa	Europe	†
,,	Spintherops spectrum	,,	†
19 Geometrae	Odontopera bidentata	,,	*aa*
,,	Eugonia autumnaria	,,	*aa*
,,	Eugonia fuscantaria	,,	*a*
,,	Epione Apiciaria	,,	††
,,	Pericallia syringariae	Europe	††
,,	Rumia crataegata	Britain	
,,	Acidalia luteola	,,	‡
,,	Numeria pulverari	,,	‡
,,	Cidaria sagittata	,,	‡
,,	Eucosmia certata	,,	‡
,,	Eupithecia togata	,,	‡
20 Galleriae	Galleria mellonella	,,	
21 Pyralidae	Eurycreon turbidalis	Hungary	‡
22 Tortricina	Tortrix viridana	,,	*a*
23 Talaeporidae	Talaeporia politella	Europe	*aa*
,,	,, pseudobombycella	,,	†
,,	Solenobia clathrella	,,	*aa*
,,	,, pineti	,,	*aa*
,,	,, triquetrella	,,	†
24 Lypusidae	Psilothrix dardoinella	,,	*aa*
25 Tineidae	Tinea pellionella	,,	‡
26 Hypionomeustidae	Hyponomeuta evonymellus	Britain	*a*
,,	,, padi	,,	
,,	,, plumbellus	,,	*a*
,,	,, padellus	,,	*a*
27 Pentellidae	Cerostoma denitella	,,	
,,	Harpipteryx harpella	,,	
,,	Plutella xylostella	,,	

LIST OF SILK AND OTHER EXHIBITS.

1. Entomological case of arranged moths, larvæ, cocoons, and silk: *a.* Larva of Tussur silk moth, Antheraea mylitta; *b.* Male and female moths of Antheraea mylitta; *c.* Cocoons, whole, pierced and showing chrysalides; *d.* Tussur raw silk, native reeled at Fatwah; *e.* ditto reeled by the Italian method by Messrs. Louis Payen and Co., at Behrempore; *f.* Male and female moths of the Chinese Tussur silkworm, Antheraea pernyi; *g.* Cocoons of Tussur silkworm, Antheraea pernyi; ditto in oak leaves; *h* Chinese reeled silk of Tussur silkworm, Antheraea pernyi; *i.* Larva of Bombyx mori; *j.* Male and female moths of Bombyx mori; *k.* Cocoons of the mulberry-fed silkworm, Bombyx mori, Italian, white; *l.* ditto, yellow; *m* Hot-weather cocoons, Bombyx cræsi, and cold-weather cocoons Bombyx fortunatus of Bengal.
2. Large diagram of larvæ, moths, and cocoons, natural size and enlarged, and raw-silk: *a.* Tussur silkworm or larva; *b.* Tussur moth, Antheraea mylitta; *c.* Tussur cocoon showing pedicular attachment; *d.* Chinese Tussur moth, Antheraea pernyi; *e.* Chinese Tussur cocoon; *f.* Mulberry fed silkworm of commerce, Bombyx mori; *g.* Bombyx mori moth.
3. Large drawing of native Arrah women reeling and winding Tussur silk by their native methods.
4. Large drawing of the European method of cocoon reeling with the Italian Tavelette Keller.
5. Diagram of the microscopic appearance of tussur silk fibre, longitudinally and in section. Ditto, ditto showing separated fibrillæ.
6. Ditto, ditto, of the ordinary silk of commerce, Bombyx Mori, longitudinally and in section.
7. Five bottles containing silkworms in spirit: *a.* Larva of Bombyx mori; *b.* Larva of the Tussur moth, Antheraea mylitta; *c.* Larva of Cricula trifenestrata; *d.* Larva of the eri moth, Attacus ricini; *e.* Larva of the Muga moth, Antheraea assama.

8. Grapelike clusters of the cocoons of Cricula trifenestrata, from Ranchi, Chutia Nagpur, Bengal.
9. Three hand-reels used by the natives for reeling Tussur cocoons. One hand-reel used by natives for reeling ordinary cocoons.
10. The Italian Tavelette Keller.
11. Map of India.
12. Convoluted flat tape of tin-plate showing scintillations of Tussur silk.
13. Cylindrical rod of the same material, showing equal diffusion of light.
14. Santal bow and arrow.
15. Hortus siccus of the tussur food-plants, with tussur cocoons attached to the branches, collected by the Rev. A. Campbell in the Santal Jungles in Gobinpore, Manbhum: *a.* Terminalia tomentosa; *b.* Terminalia chebula; *c.* Terminalia arunja; *d.* Terminalia bellerica; *e.* Shorea robusta; *f.* Zizyphus jujuba; *g.* Lagestroemia parviflora; *h.* Careya arborea; *i.* Diospyros tomentosa; *j.* Alstonia scholaris.
16. Tussur cocoons from Gaya.
17. Samples of Tussur raw silk reeled by Messrs. Louis Payen and Co., at Behrempore.
18. Woodcutter's knife-belt with jingle-bells of tussur cocoons.
19. Tussur silk spun into yarn for weaving into sealcloth; three sizes, dyed and undyed, manufactured and lent by Messrs. J. Bradwell & Co., silk spinners and merchants, Congleton.
20. Seal plush.
21. Dinner-table centre on satin, worked in Indian Tussur silk, designed by the late John Sedding.
22. Tussur silk reeled at Fatwah.
23. Four specimens of 1 metre each, of brocades, the ornamenta parts of Indian Tussur silk, woven in patterns of Louis XVth and Louis XVIth styles; manufactured by Messrs. Lamy & Giraud, Lyons.
24. Small example of gold-coloured damask, manufactured by Messrs. Perkin & Sons, 27, Curtain Road, London, E.C.
25. Example of cream-coloured figured damask, Indian Tussur silk, manufactured by Messrs. M. Perkin & Sons, 27, Curtain Road, London, E.C.
26. Three samples of Indian Tussur silk, figured damask, woven in Leek, in 1879.

27. Two specimens of French-made open work dress damasks, Indian Tussur silk.
28. Tussur Silk Chenille in various colours, and cut in a variety of patterns.
29. A series of Tussur Chenilles, chenille fringes, trimmings, tassels, toy monkeys, and swans, deep fringes of wool and tussur mixed, and pom-poms manufactured and lent by Messrs. W. and G. Kessler, Berlin.
30. Series of Satin Damask and Brocade of Indian Tussur silk, manufactured by Messrs. Devaux and Bachelard, of Lyons, 1 metre each.
31. Six samples of Indian native woven bleached Tussur silk, and three examples of Indian native woven unbleached Tussur silk for dresses; printed by Thomas Wardle, Leek.
32. Indian Tussur silk tram, dyed to the colour of 14 precious stones, by G. C. Wardle, Leek.
33. A bundle of three threads organzine of Indian Tussur silk, manufactured by Messrs. J. and T. Brocklehurst and Sons, Macclesfield.
34. Lace, manufactured by Messrs. J. Kirkbride and Co., St. Mary's Gate, Nottingham; the pattern part is made of Indian Tussur silk, thrown by Messrs. J. and T. Brocklehurst and Sons, Macclesfield.
35. Cream coloured bleached opera fichu, of Indian Tussur silk, lent by Mr. Maas, of Berlin; also pocket handkerchief and pieces of Tussur silk for rain and dust cloaks, lent by Mr. Maas.
36. One 10-yard piece of native woven Tussur silk, "Dhoti" for men's wear, woven at Giridi, Bengal, undyed, with red border.
37. Indian Tussur raw silk, reeled by Messrs. Louis Payen and Co., at Behrempore.
38. Three bottles of powdered Tussur silk, for surface coating; a new French utilization.
39. Native spun and woven undyed cloth, made of the silk of the Atlas worm, Attacus atlas, Nepal Terai; red plaid on undyed ground.
40. Sozni, or Bedcover, embroidered at Peshawur.
41. Doopata (turban) of cotton, embroidered with undyed Muga silk. Worked at Dacca, Bengal.
42. Embroidered silk on cotton phulchari. Made and worn in Amristar, Punjaub.

43. Embroidered border on satin, from Cutch, Bombay.
44. Berlin Tussur Silk Shawl.
45. Bi-coloured net. A marriage robe, most curiously dyed red on one side and green on the other. Ulwar.
46. Leek re-production of the effect of dyeing a different colour on each side as in the Ulwar sample. By Bernard Wardle.
47. Very interesting and ancient Indo-Persian figure weaving.
48. Trimmings for ladies' hats, manufactured from Tussur silk.
49. Tussur silk cocoons attached to branches.
50. Cocoons of Anthraeaopsis Assama or Muga silkworm of Assam.
51. Raw silk ditto ditto ditto
52. Italian cocoons of the Bombyx Mori from Bozzoli.
53. Bengal cocoons of Bombyx Fortunatus or Desi caterpillar, November bund.
54. Case containing samples of the improved reeling of Bengal silk.
55. Native woven Tussur silk cloth cleaned.
56. { Silken dwelling place of colony of Cnethocampa.
Processionea or processional caterpillar. From the Riviera.
57. Turban, Bandana or tie and dye work, from Jeypore.
58. Ditto ditto ditto Ulwar.
59. Gujrati Bandhana or tie and dye work in spots and borders of four colours, partly tied, from Jeypore.
60. Satin handkerchief, tie and dye work, from Jeypore.
61. Elaborate specimen of tie and dye or Bandhana work, Ulwar.
62. Illustration of the Great Buddhist Temple at Buddha-Gaya near Gaya, Bengal.
63. Ancient Coptic silk fabric IV century. From Echmine, Upper Egypt. Part of the clothing of rich Christian men and women of the time.
64. Modern reproduction of ditto ditto ditto.
65. Fragment of Silk found by Mr. Flinders Petrie, in a Christian coptic grave of the 6th century, A.D., at Fayum, Egypt, 1891.
66. Modern reproduction of ditto ditto ditto.
67. Pattern of the Silk Brocade with silver May blossoms, which has been lately woven in Spitalfields, by Messrs. Warner and Sons, for the bridal dress of Princess May of Teck.

68. Two designs found on the robe of St. Cuthbert, in his tomb in Durham Cathedral, date abont 1200, printed by Thomas Wardle.
69. Samples of modern silks woven at Spitalfields, by Messrs. Warner and Sons.
70. Samples of modern silks woven at Leek by Mr. G. H. Bermingham.
71. Cocoons of Coccidae, Eriopetis festucae, Signorctia luzula, Britain.
72. Case containing moths and cocoons of galleria cerella formed by larva in the honeycomb of the beehive.
73. Case containing moths and cocoons of Bombyx rhadama also sac or cocoon bag containing cocoons.

SECTION A.—ZOOLOGY.

CHAIRMAN.—MR. MASEFIELD.

REPORT 1891-2.

The cold and wet spring and summer, and I may also add autumn of 1891 was disastrous, not only to observations and study of wild animal life, but also to wild animal life itself. In proof of this, more than an average number of deserted wild birds' eggs and nests came under our notice during last year, the eggs having no doubt become addled through cold. Further, the number of dead young birds found in the spring and summer of last year was, I believe, phenomenal, as well as the number of weakly young ones which, in all probability, had not strength to survive the cold winds and wet. Some entomologists even attribute their successful captures to the destruction of so many insectivorous birds during the early summer. Many of you will recollect our visit to a real wild home of the Badger last May near the Weaver Hills. To those who were not present, it may be interesting to note that the entrance to this animal's abode was in a secluded dell through a narrow cleft in the solid sandstone rock, and so narrow is it, being only about six inches wide, that the sides of the entrance are rubbed quite smooth, shewing the difficulty the animal or animals (for I hope there may be several of them) have in passing in and out. It is an admirably chosen fortress, and I trust the badgers may be able to hold it securely against all comers, and so a remnant of this fast disappearing species may be preserved for many years to come. At our last Annual Meeting you will no doubt recollect the very interesting group of living Bats exhibited by Mr. Collins, who deserves our special thanks for bringing these bats, of which it is so difficult to procure specimens for study, to our notice. Mr. Collins informs me that they were found hibernating in a hollow ash tree near the lake in Trentham park. They all proved to be male or female specimens of the Great Bat (Scotophilus noctula). The question

has often been raised as to whether this species hibernates or migrates in the winter to southern climes, but this discovery by Mr. Collins goes far, I think, to show that this bat is a hibernating, as well as a tree-inhabiting, and gregarious, species with us. It seldom appears on the wing before May, and is seldom seen about later than August, so that it would appear to have but a very short active life of about four months in each year. Several of these bats, which I forwarded to Messrs. Hardy and Standen, of Owen's College, Manchester, were kept by them for some time in captivity, and got quite tame, feeding on cockroaches (Blatta-Orientalis). Mr. Collins has recently informed me of the discovery of an immense number of dead bats under the roof of one of the lodges in Trentham park, but unfortunately he did not save any specimens so as to identify the species. The members of this section will feel really grateful if any specimens of bats which may be met with are forwarded, to enable us to learn more about our local species of these useful animals. A specimen of the long-eared bat (Plecotus auritus) was procured at Cheadle in November last, but this is a comparatively common species. In September last the occurrence of two specimens of the Dormouse (Myoxus avellanarius) at Oakamoor, was reported to me. Our Bird notes for the past year include the following dates of arrival of some of our summer migrants :—

4	March	Chiff-Chaff at Market Drayton.
8	„	Chiff-Chaff at Madeley, and here I may note that instances have been observed of recent years of this delicate little bird having remained all through the winter, in sheltered localities, in Devonshire, Somersetshire, Gloucestershire, and in Ireland.
6	April	Sand Martins at Madeley; on 7th and 8th, two cold days, they were not observed, but appeared again on the 9th.
14	„	Swallow at Madeley.
19	„	Willow Wren at Cheadle.
20	„	Wheatear at Mow Cop.
24	„	Swallow at Cheadle.
24	„	Cuckoo at Madeley.
29	„	Sandpipers near Cheadle.
3	May	Corncrake „
9	„	Sedge Warbler at Madeley.
18	„	Swift at Eccleshall.
5	June	Grasshopper Warbler at Madeley.

On 7th November last House Martins were still to be seen at Cheadle, and this is the latest date reported of their stay with us.

Young Rooks were hatched in my rookery on 2nd April.

Mr. Ernest Blagg informs me that about the 16th March is the average date for the Rooks at Cheadle to return permanently to their breeding localities, up to that date returning to their winter quarters at night, and he does not consider that the severity or otherwise of the weather makes much difference in the date of laying the first eggs, when, and not till when, the birds remain at their nesting places—the sitting hens stay at first only. The aspect of a rookery seems to have some effect as to date of nesting. Mr. E Blagg's notes showing that in the case of three rookeries all within the distance of a mile, the first facing the south appears to be a few days earlier than No. 2, which faces nearly east, and No. 2 is again earlier than No. 3, which is a little further to the north.

The Rev. T. W. Daltry has again kindly furnished me with the following interesting observations on our local birds:—During December, 1890, and January, 1891, a Green Woodpecker (Picus viridis) paid daily visits for some time to his Garden at Madeley, to feed on the berries of the Pyracanthus. This shows the terrible severity of the season, as the Woodpeckers are pre-eminently insectivorous birds, as shewn by the structure of their tongues. In May last a hen Sparrow Hawk was killed at Madeley Vicarage by flying against a plate-glass window, and as in similar cases, there was found a spot of greasy fluid at the point of impact, no doubt exuded by the blow. On 8th January last, a Bittern was shot at Little Madeley, and is exhibited here to-night. A small flock of Goldfinches were also noticed at Little Madeley during the same month. This is becoming a rare bird with us, owing to the persecution of birdcatchers. On 23rd February last, a freshly-laid Starling's egg was picked up at Madeley, a very early date.

Mr. Wells Bladen kindly sends me notes of the occurrence of Cross Bills at Swynnerton, of the Manx Shearwater near Stone, and of the nesting of the Woodcock in Bishops Woods last year.

Mr. Ernest Blagg reports the nesting in our district of the Water Ouzel, Grey Wagtail, and Stock Dove. Also an instance of a Cock Sparrow of a whitish colour taken near Cheadle, and a pure white Blackbird was also taken near Cheadle last year. Mr. Blagg

further notes a case of a Robin mottled with white about the head and upper portion of the back. This bird he saw at Forsbrook a few weeks ago. On 27th February last he reports a Gull on the wing near Stanton, very tame, and flying close overhead and quartering the ground in search of food. The species he believes to have been the Common Gull (Larus Canus), but an immature specimen, being still partially mottled with brown. On Thursday last an immature Kittiwake Gull (Larus tridactylus) was picked up in an exhausted condition, and with a frost-bitten foot in Cheadle churchyard. It only survived one day, although it partook of a hearty meal, but I am afraid the amount of handling it had to endure in being exhibited as a curiosity tended to a great extent to its death. I exhibit it on the table to-night. Last week (6th March) we received a visit at Cheadle from a flock of about 40 Golden Plovers (Charadius pluvialis) associating with a number of the common Green Plover or Lapwing. Mr. Blagg was able to approach within 15 yards or so of some of the flock, and to observe that they were already assuming the rich black plumage of the breast which this bird takes in the breeding season. The flock was no doubt on migration to their breeding grounds in the north.

Mr. Hill reports the occurrence of the nightingale near Modder-shall last summer. This is rather a high latitude and exposed situation to meet with this bird, and the song of some of our other warblers, which sometimes sing at night, is frequently mistaken for it. I am afraid I am getting somewhat sceptical as to the occurrence of this bird in North Staffordshire, especially since I came across the following advertisement, quoted in a daily newspaper: "Charles Richon, Imitator of Nightingales for Gardens and Restaurants." No doubt a most lucrative employment for this accomplished gentleman, but I hope he will confine his melodious powers to *public* gardens. An unusual light blue colouring in the eggs of the Spotted Flycatcher I found at Caverswall last year, the usual colour being a creamy ground colour blotched with dull red. An instance of the trust and confidence shown by birds in the kindness of man, or perhaps, as Mr. E. Blagg thinks, of the attachment for their young, was related to me, which occurred in the gardens of Caverswall Castle last year. A painter had occasion to remove a Thrush's nest containing young ones, to enable him to complete his work; this he carefully did, placing the nest at a little distance from where it was built; the old bird continued to feed her young while the nest was in its new position, and the man afterwards replaced it in its original position, and the young were successfully reared.

Of the usefulness of our wild birds I have received valuable testimony from Mr. Cherry. He informed me that whilst the leaves and blossoms of certain fruit trees which he had carefully protected from the birds were eaten up by caterpillars, other trees not so protected retained their foliage and produced a crop of fruit.

Dr. McAldowie reported a pure White Swallow at Trentham last year, and a more beautiful object than an albino specimen of this graceful little bird one can scarcely imagine.

As to our local Reptiles and Amphibia I have not time to say more than to refer to my introductory paper on this subject, read at our last Evening Meeting, and to say that this Section invites information and observation from our members on this subject. One of our members has already put himself in communication with me as interested in the subject, and wishing to learn more as to our local Herpetology, and Mr. G. A. Boulenger in this month's number of the *Zoologist* has a most interesting article on the Viper and invites accurate statistics shewing the varieties in colour in the Viper in limited areas. He also states that "it is now known that the Viper feeds on small mammals, such as mice, voles, shrews and moles, young birds from the nest, lizards, and batrachians, thus drawing for their bill of fare on all four classes of Terrestrial Vertebrates."

Mr. Wells Bladen has supplied me with a note of an alleged instance of a Frog (or Toad?) found last August in a bed of marl, 10 feet below the surface. The animal was replaced in a hole in a piece of stone, the front of which is covered with glass. I hope to shortly inspect it, and to obtain full information as to the facts.

Our Conchological Section has, I am happy to say, obtained a valuable recruit in Mr. A. F. Daniel, and he has already done good work, and reports new localities for several species, notably Helix aculeata, H. pygmea, and H. rotundata var. albinos from Sandon, and Neritina fluviatilis from the canal hard by. This is the most northerly locality in this canal that I have heard of this species being met with. Mr. Burrows reports Cotton Dale as a new locality for Helix fusca and H. excavatus. In connection with this branch of our Section, I am glad to say that at the Annual Meeting of the Conchological Society of England, held at Owen's College, Manchester, in November last, the name of one whom I think I may without doubt refer to as our leading Staffordshire naturalist, was mentioned as the probable President of the Society

for 1893, when I hope the Conchological Society may be induced to hold its Annual Meeting and Exhibition of Specimens in this county, and that the members of our Club will give it a hearty welcome. At the Manchester meeting I had the honour of being elected on the Council for the present year.

Before closing this report, I must briefly refer to the loss this Section has sustained by the removal from the district of Mr. James Yates. He from time to time furnished us with valuable notes, especially on local Ornithology and also on Botany, with both of which subjects he was so well acquainted. With my thanks to all members of our Section for their assistance and notes during the past year, and with the hope that more of our members will become observers and join in the sectional work, I close the report of the Zoological Section of the past year.

AN INTRODUCTORY PAPER

ON OUR

LOCAL REPTILIA AND AMPHIBIA.

By JOHN R. B. MASEFIELD, M.A.

As I fear most of my hearers have recently passed through an attack of that scourge, euphoniously called "influenza," you will realize how I must have felt during the convalescent stage of that disease, upon receiving an application to write a paper for our next Winter Meeting. Under ordinary circumstances, to write a satisfactory paper for our Society certainly takes a much longer time than an otherwise busy man can give to it in three weeks; and the attempt to write a cheerful paper under the circumstances I have mentioned was, I think, about the last straw needed to break the camel's back. This intended paper was for our Stafford Meeting, which however, from unforeseen circumstances, fell through this year, and I thought I was freed from any task. Imagine then my feelings on receiving another application a week later from Mr. Earl, for a paper for Newcastle, to be held on the same date as the original fixture for Stafford. I pleaded for more time, but in vain. Mr. Earl would neither let me off, nor could he give me more time, so in a weak moment I promised to do my best, as I always like to do what is in my power to further the work of our Society. No time could be lost, so I was obliged to stir up what little energy the influenza had left me and select a subject. You will probably say that my then somewhat impaired state of health must have caused me to select such a horrible subject as crawling, slimy, ugly reptiles. No, I can assure you that it was not so, and when in the best state of health I look upon such creatures as amongst our most interesting and most useful animals. In our Transactions I find little noted as to our local Herpetology or study of our Reptiles, with the exception of a most interesting lecture upon the habits and life history of some of these animals, delivered at Yarlet, by

the late Rev. J. G. Wood, in 1877, and a paper read at Cheadle, in 1889, but this treated of British and Foreign Reptiles generally. The Reptilia I need scarcely remind you, according to Linnæus and Cuvier, form one of the four great classes of the Vertebrata, but this class is by some modern Zoologists divided into two classes, Reptilia and Amphibia, and by others the latter is treated as a distinct Order. In either case the Amphibia form the intermediate link between the true Reptiles and Fish. The term Amphibia was also applied as you know by the older naturalists to certain Orders of the Mammalia, such as the Seals, Otters, Beavers, Water Voles, and even the Hippopotamus; but now the term Amphibia is by Zoologists applied solely to certain animals which Professor Bell has defined as "Vetebrate animals, with cold blood, naked skin, and oviparous reproduction, and most of them undergoing a metamorphosis having reference to a change of condition from an aquatic to an atmospheric medium of respiration." Such a definition you will find applies to and includes the Frog, Toad, and Newt, of which I shall presently have more to say. The true Reptilia are cold-blooded Vertebrate animals, with oviparous or ovoviviparous reproduction, covered with horny plates, scales, or leathery skin, and whose respiration is aerial and incomplete. For the purposes of this paper we will for brevity's sake consider the Amphibia as a Sub-Order of the Reptilia, *so that the latter term may include both.* The term cold-blooded is, I fear, frequently misunderstood, and it may be well to explain that what we call warm-blooded animals (birds and mammalia), have a certain "permanent heat in all atmospheres," while the temperature of the others, which we call cold-blooded, is "variable with every atmosphere." For this reason we see many of these Reptiles taking advantage of basking in the sun, and hence also as the atmosphere grows colder in the autumn and winter, so Reptiles get more and more sluggish until they become completely torpid and digestion ceases, and so it is not surprising that life is sustained during hibernation. On the other hand as the weather in spring and summer becomes warmer, Reptiles become more and more active, and it is only in the hottest weather that their vital powers are exerted to their full extent. So in the warmer and tropical countries we find the number of species of Reptiles and Amphibians much larger than in our climate.

We will now proceed to notice the different Orders, Families, and Species of the Reptilia and the Sub-Order Amphibia found or likely to be found in our North Staffordshire district. The whole number of species of Reptiles which have ever been met with in Great Britain in a feral state is only 17, and this small number

even includes one very doubtful occurrence in a wild state, and two species which are now decided by the best authorities to be only varieties of another species. The 17 also include accidental visits of two other species which I will explain shortly, but according to the now established custom of naturalists, a single well-authenticated occurrence of a Foreign species is sufficient to warrant its being included in our British lists. Others included in our 17 species are purely local, so that our list of local Reptiles becomes reduced to only 8, which we know to be really indigenous to North Staffordshire. 3 or 4 other species or varieties may possibly, but very improbably have occurred, and await re-discovery by our members if they will take up the study of these animals. Taking then the whole British list, which is so short, we will first very briefly notice those *not* likely to occur in North Staffordshire, and shewn in *red* ink on the diagrams.

Order Testudinata, Family Cheloniadæ.

Chelonia imbricata, Hawk's Bill Turtle.

This is an American species said to have been taken in our seas three times during last century.

Sphargis coriacea, Leathery Turtle.

A Mediterranean species, twice taken in mackerel nets off Cornwall, once off Dorsetshire, and once at Scarboro'.

Cistudo Europæa, Spotted Marsh Tortoise.

This European species is stated by Brown in Sir Oswald Moseley's Natural History of Tutbury, as having been taken on the banks of the canal at Burton, in 1857, probably an escape, although the bones of this species have been found only seven feet beneath the surface in peat, in East Witham, in 1836.

Order Squamata, Family Lacertidæ.

Lacerta Agilis, Sand Lizard.

Mr. Garner inserts this beautiful species in our list on the authority of Mr. Brown, as having occurred at Burton, but Sir Oswald Moseley states that this was a case of mistaken identity, the species found being really the Common Lizard. The Sand Lizard is local in England, being found in the neighbourhood of Poole, in Dorsetshire.

(1) *Zootoca vivipara*, Common or Viviparous Lizard.

(2) Family Anguidæ. *Anguis Fragilis*, Blind Worm.

(3) „ Colubridæ, *Natrix Torquata*, Common Snake.

„ „ *Coronella lævis*, Smooth Snake.

This is a local species found in Hampshire and a few other localities.

(4) Family Viperidæ, *Pelias Berus*, Viper.

CLASS AMPHIBIA.

Order Anoura, Family Ranadæ.

(5) *Rana temporaria*, Frog.

„ *esculenta*, Edible Frog.

A local species in Foulmire Fen, Cambridgeshire, and in Norfolk

(6) Family Bufonidæ, *Bufo vulgaris*, Toad.

„ *calamita* Natterjack.

Another local species on sandhills, near sea coasts, and Blackheath, and other places, distinguished by a bright yellow line down the back, and much more active than the Common Toad.

Order Urodela, Family Salamandridæ.

(7) *Triton Cristatus*, Warty Newt.

„ *Bibronii*, Straight Lipped Newt.

Once occurred in England, now considered only a variety of Cristatus.

(8) *Lissotriton punctatus*, Smooth Newt.

„ *palmipes*, Palmated Smooth Newt.

This is now considered only a variety of cristatus, and found locally, but as it has been reported from Sutherlandshire, and also in the Isle of Wight, why should it not occur in Staffordshire? It may be distinguished in the male by the webbed feet. Here is a new record to be made by one of our members.

Now, having practically reduced our local list of Reptiles to eight species; I will as far as time will permit, cursorily describe each of these species. The study of the life-history of each of these animals, as well as the observation of their habits is most interesting and instructive. I don't think so much has been written about any animal as about the Frog, yet, I am sure its usefulness, and also the benefit which we derive from our other

local Reptiles, is not sufficiently well-known, or we should not have these useful creatures so despised, and contemplated with such horror, so ruthlessly tortured and illtreated, and so often needlessly destroyed. All these Reptiles may be kept in confinement for purposes of study with great advantage, including even the dangerous Viper, which I have myself kept for a time, if only they are carefully looked after, supplied with water to drink, which is a point often overlooked in pet animals, and provided with an environment as much like nature as possible.

(1) *Zootoca vivipara*, Common Lizard. This very harmless creature, and the only species of Staffordshire Lizard, is frequently to be seen on our heaths and commons, especially where furze abounds, such as Cannock Chase, the Downs near Stone, and other similar localities. It is from 5 to 6 inches in length, and a greenish brown in colour, with the under side bright orange yellow in the male and greyish green in the female, but the colouring varies considerably. Just after it has cast its skin, which it does every few weeks, its colours are almost irridescent and more beautiful than can be described. The eye is very bright and expressive, and has been truly described as resembling a black bead set in a bright orange rim; its movements are graceful and nimble, and it darts about so quickly that the only chance of observing its habits is to remain perfectly still; the slightest movement on the observer's part causing it to dart away instantly to a place of concealment and safety. I have often been struck by the way in which this Lizard can climb through a furze bush, without receiving injury from the furze needles, which no doubt glance off the scales of the body, if they ever come into contact, but as far as I have been able to discover, the Lizard avoids them entirely in some wonderful way. I have never kept this little animal long in captivity, owing to the difficulty in obtaining appropriate food, which consists of flies, bees, beetles, caterpillars, and it only takes these in a living state. Lizards are however often tamed, and make most interesting pets. If caught by the tail, this Lizard has the power of snapping off that organ and so escapes from its foe. I once captured a specimen in this tailless condition. The tail begins to grow again in two months, and is completely renewed at the end of another month from that time. Reproduction is ovoviviparous, the young from 3 to 6 in number being hatched the moment the eggs are deposited or immediately afterwards, and they are able at once to run about and capture their own food.

(2) *Anguis Fragilis*, Blind Worm or Slow Worm. This and the Lizard I have just described are certainly my two favourite

Reptiles; both being perfectly harmless and gentle creatures, they may be handled with impunity. Although in outward appearance the Blind Worm has some resemblance to a snake, yet it really partakes as much or even more of the general character of a Lizard, the head being of a Lizard-like form and having consolidated bones and limited gape, and a body of the ophidian or snake form. For this reason the Sub-Order is named by Mr. Gray, Saurophidia meaning Lizard-Snakes. This animal occurs frequently in our woods and on our heaths, and localities mentioned by Garner are Whitmore, Wybunbury, and Chartley, and the Limestone Hills in the north of our county, near which I have seen it myself. It is the earliest of our scaled Reptiles to appear in the spring, emerging from its winter retreat with the opening leaves of the trees. In character no more harmless and gentle animal exists, and it has frequently been kept as a pet by ladies, and trained to take its food from them, which consists almost entirely of the white variety of the common small slug (Limax agrestis) and worms, and it will drink milk in confinement. The Blind Worm does not exceed 12 to 14 inches in length, and the body is of about an equal thickness throughout, and as Bell says, slightly tetragonal. Its scales have a silvery brown appearance, with a darker line down the back, and the under parts are a bluish black, the eyes are charmingly expressive and bright, resembling those of the Lizard; the tongue is notched, which is, I am afraid, quite enough to inspire ignorant persons with fear. When taken up, the Blind Worm has the faculty of stiffening its muscles to such an extent that it frequently snaps in two, the tail end continuing to wriggle and jump about for several minutes after severance, and as this takes off the attention of its enemy, the other portion of the Blind Worm escapes to a place of safety. It sheds its skin in one piece in the same manner as snakes. Like the Lizard it is ovoviviparous, and the number of the young is from 10 to 12. Little is I think really known as to the age of Reptiles, but a Blind Worm has been kept in confinment for no less than 28 years.

(3) *Natrix Torquata*, Ringed or Common Snake. This is the commonest of our true Reptiles, and is found in woods, heaths, dry hedgerows, and country gardens, to which latter it is often attracted by the heat generated by heaps of leaves, rubbish, &c. It is not however found very far away from water, in which it delights to take a bath, even as late in the year as October, when Mr. Ernest Blagg met with one swimming across one of the pools in Dimminsdale, near Cheadle. This snake belongs to a perfectly harmless family, the Colubridæ, none of which possess any poison glands. The only power of defence is that of emitting an extremely strong

and unpleasant odour, so that gentleness in handling this snake is necessary. In length it often attains to 3 to 4 feet, and the general colour is brownish green, with a bright yellow ring round the neck, and rows of alternate black spots along the whole length of the body, the head is considerably compressed, and the upper part consists of broad flat plates, the tongue is bifid or forked for about one-third of its length, but pray do not imagine for a moment, as is so generally supposed, that the forked tongue of this or even of the Viper, or any poisonous snake is a sting or has any connection with the poison glands. This however, I will endeavour to more fully explain when we come to the Viper. This species is oviparous, the eggs being laid in decaying matter, and hatched by the warmth arising therefrom, and by the heat of the sun. The number of eggs is from 16 to 20, and they have a soft, leathery covering, and are laid in a string. The favourite food of this snake is undoubtedly the frog, but they also feed on toads, mice, and moles, young birds, newts, fish, &c., &c. I have not time to describe fully how this creature with so small a head and mouth is able to swallow a large frog, but to those of our members who had not the privilege of hearing the late Rev. J. G. Wood's lecture on this subject a few years ago, I may just say that the bones of the head of the snaks are permanently separated, and open as it were when required, the skin stretching at the same time, to allow the food to pass, much in the same manner as I have seen a lady's jet bracelet composed of separate pieces of jet joined by elastic, stretch open to allow the hand to pass through it. The skin of the snake is changed many times in the year, and peels off inside out. As soon as the cold weather commences, numbers of snakes collect and hibernate, coiled together for warmth. I am told that many congregate in this way amongst stones, and in walls near the large limekilns at Froghall, attracted by the heat of the large fires. I have mentioned young birds as forming part of the snake's food. This necessitates the snake being a good climber, and of this I have myself had ocular evidence. When shooting in a thick wood near Cheadle in the autumn, I suddenly saw on a level with my eyes and about two feet in front of me, a snake coiled up and apparently basking in the sun on the top of a hazel bush. He had evidently only recently cast his skin, and his fresh bright colours in the sun, with the background of dark green leaves, would have made a beautiful study for an artist's pencil. The strength of snakes is far beyond what their size would lead one to imagine. Mr. E. Blagg tells me that it once took so much strength to pull a common snake out of a loose stone wall in which it had partly taken refuge, that he was afraid it might have been pulled in two. Through setting up its scales it was almost able to resist his endeavours. In our large public

schools in the south, snakes are very frequently kept as pets, and snake swimming races across ponds I believe are a great source of amusement on holiday afternoons.

(4) *Pelias Berus*, Viper. We now come to the dreaded Viper or Adder, as it is frequently called, the only poisonous British Reptile (unless a secretion from the toad is poisonous, which I doubt), but Professor Bell states that he has never yet been able to verify and trace to an authentic source any of the numerous reports of a *fatal* result to man caused by the bite of a viper; at the same time he admits that such an event might occur. A fatal case was however most circumstantially stated in "Land and Water" for 1st February, 1868, and many other fatal cases attributed to the bite of a viper are to be found in the volumes of *Science Gossip* during the last 20 years, but in many of these cases it is stated that the subject was not in a perfect state of health, so that, I think we may conclude that although many cases of death may be *indirectly* attributed to the bite of a viper, the evidence is not altogether conclusive, as far as I have yet read, that death has been ever *directly* caused by the poison of a viper. Fatal effects have resulted as we know indirectly from the sting of a wasp, and many other apparently trifling injuries. The viper is frequently to be found early in the summer on sandy heaths and commons. Localities where I have met with them are Cannock Chase and Chartley. Mr. Garner also mentions Whitmore and Wybunbury. Its length is from 18 inches to 2 feet. In colour there is great variation; it is generally olive or dark brown, but specimens have been taken of brick red, black and even white in the general ground colour. Fortunately this species may always be distinguished from the harmless common snake by the head, being much broader behind the eyes, and by the "skull and cross-bones" marking, as it is called on the head, and the dark zigzag chain of diagonal or rather rhomboid shaped black spots running the whole length of the body (see diagram.) And now let me impress upon you that no one need really be afraid of this reptile, as it only strikes in self-defence, or in seizing its prey, and unless teased or trodden upon it always endeavours to get away from a human being if possible, as I have myself experienced, making it extremely difficult, except for a professional to catch a viper alive. Its food resembles that of the common snake. A Viper has been known to swallow nine mice one after another, and another to swallow a blind worm. After feeding on young birds in a nest, a Viper has been found curled up in the nest much to the alarm of the parent birds, so beware, collectors of birds' eggs. Reproduction in the case of the Viper is ovoviviparous. Bell is somewhat incredulous as to the fact of Vipers on approach

of danger swallowing their young, but very numerous and apparently truthful statements have been made by eye-witnesses of this alleged fact, especially by the professional viper catchers of the South of England, and it is difficult to understand how they can be mistaken. I must not close my notes on this Reptile without shortly describing how it inflicts its poisoncus wound, and please remember that the forked tongue has nothing whatever to do with it. The fangs or tubular teeth are situate in the upper jaw, and in the normal state of rest lie in a flat position, pointing inwards along the jaw, and are covered with a membrane of flesh. The poison is secreted in a sac at the side of the head, connected by a duct with the fang. When the animal becomes excited the fang is erected forwards by means of a muscle, and when the Viper strikes its victim the pressure of the tooth or fang forces a minute drop of the poison through the hollow tooth into the wound. You will therefore see that the wound is inflicted not so much by an actual bite, but after first erecting the head by striking the fang in a downward direction into its foe. The poison has been proved to be harmless if taken internally, unless, of course, there is any sore on the lips or internal injury. If any of my hearers should have the misfortune to be wounded by a Viper, the most efficient remedy is said to be that of instantly sucking the poison out of the wound, but this must be done *instantaneously*, or by use of olive oil externally, and ammonia or brandy taken internally, may be tried, but if there should not be a doctor at hand, I trust one of our certified St. John's Ambulance Pupils may be on the spot.

We now come to the Sub-Class Amphibia or Batrachia, and the first Staffordshire species of which is

(5) *Rana temporaria.* The Frog, so well-known I am sure to all that it requires no description from me, so I will only state two facts perhaps not generally observed, namely, that it has only four toes on each of the front feet, and five on each of the hind feet, and that in colour it varies to an almost chameleon-like extent. Its food consists entirely of living insects, worms, moths, especially of the Order Noctuæ, and molluscs, and it is therefore a most useful animal, and should be carefully protected, both by the gardener and farmer. I will only add a very short and cursory notice of its development from the egg, as illustrated by this diagram, and which you may each study for yourselves during the next two months from nature herself, and for full particulars I would refer you to Dr. McAldowie's excellent notes on the subject, in *Science Gossip* for 1878 and 1882. In March, Frogs emerge from hibernation in the mud, and assemble in ponds and ditches for breeding purposes.

I may perhaps give you an idea of the numbers which congregate in a small space by the following incident, which occurred a few years ago. When passing through Moddershall with a friend, our attention was suddenly arrested by a musical croaking or rather, I should call it warbling, a few yards away. We proceeded in the direction of the sound, which led us to one of the many small ponds in that locality, and we soon found that the sound came from hundreds of little heads just raised above the surface of the water, which was simply teeming with frogs. We attempted to estimate the number of frogs there were, and as we actually counted from 15 to 20 frogs in every square foot, in a space of 5 square yards (and the pond appeared to be equally thickly populated all over) there must have been at least 3500 frogs. The eggs are deposited at the bottom of the water, and when laid consist of an embryo in a gelatinous mass, which soon absorbs a large quantity of water, and they then resemble masses of jelly dotted over with black spots, and generally floating near the surface of the water. I find a bath of this frogs' eggs jelly recommended as a cure for rheumatism, but I will not vouch for its efficacy. Of course, much depends on temperature as to the development of the eggs. Some I kept for observation last spring I found much retarded in consequence of being kept in a shady place. Bell says that in four hours after being deposited, the first change commences, on the second day the embryo begins to elongate. In 50 hours the head may be well distinguished, and the tail becomes an elongated fin. In a short period later growth appears as shown in diagram, and the first voluntary motion takes place of the embryo, which attaches itself to the membrane of the egg by two small hooks on each side of the head. Branchiæor or gills next appear, and circulation of the blood commences through these organs. By repeated jerks the embryo eventually tears the membrane of the egg and hatches. This stage is reached in about a month from the deposit of the eggs, and the infant tadpole proceeds to feed upon the albumen of the egg. The Branchiæ now further develop. After a short time the mouth and eyes enlarge further, and the Branchiæ begin to die away and the Caudal web increases. The tadpoles, for so they have become now, feed on vegetable growths and then on both vegetable and animal food during the next five or six weeks, and they increase greatly in size and become most ravenous and even show cannibal propensities. The next change is the gradual development of the hind legs and the tail becomes absorbed, the front legs follow, and the perfect little frog appears. Up to this time the tadpole has followed the character of a fish, breathing by gills, but now it becomes an air breather, and seeks land life, causing reports of frog showers so

frequently recorded in newspapers. Were it not for the numerous actual enemies of the Frog, and their cannibalistic habits during their tadpole stage, which all tend to preserve the balance in nature, we might be visited annually by a plague of frogs. Growth during autumn in a Frog is very rapid until the period for hibernation comes round again. During very hot and dry weather Frogs sometimes estivate. Frogs may easily be tamed as pets. Dr. Roots relates an attachment which sprang up between a tame frog and a cat, the frog nestling under the fur of the cat, and enjoying the warmth ; but I must proceed.

(6) *Bufo vulgaris.* The Toad. As in the case of the frog, I will not attempt to describe so well-known an Amphibian as the Toad, to members of a Naturalists' Field Club. I do not doubt that any of you who have not carefully studied this animal, will agree with Pennant of old, who described the Toad as "the most deformed and hideous of all animals, its retreat gloomy and filthy, and in short its general appearance such as to strike with disgust and horror." It is certainly true that there are more elegantly formed animals than the Toad, and perhaps of more pleasing colour and appearance, but I cannot go to the same length as Pennant in his description of this animal, and I maintain that the Toad is one of our most useful animals, and there is no greater friend to the gardener and farmer to be found in nature. When I was a boy living at Stone, we always kept several Toads in the vineries, and these became very tame, taking food regularly whilst we looked on, and allowing themselves to be taken up and stroked. One of these toads I remember well, because he had by some accident lost a leg. The gardener named him "Samson;" he lived many years, and when he had just cast his skin and appeared in all the beauty of a rich new yellow coat, mottled or spotted with dark brown, and with his bright eyes, I am sure the most prejudiced reptile hater could not have denied that he presented a handsome appearance. Insects of all kinds (except the Julidæ, which I believe both Toads and Frogs reject), worms and molluscs constitute the principal food of the Toad, but it will only eat them when they are living and actually moving. I have never yet found a worm too large for a Toad to tackle, although the process of disposing of it has sometimes given some trouble, and taken many minutes, and the Toad has not appeared quite happy for some time afterwards. Like all other Amphibians, the Toad casts off its skin at intervals, the whole cuticle peeling off, and being rolled up in a ball by the fore feet is then swallowed at one gulp. The tongue of the Toad as well as the Frog, is attached to the front of the mouth, and lies backwards between the jaws. When the Toad sees an insect or

worm it remains perfectly motionless intently watching the object, until it is within reach, and then the tongue is shot forward with the rapidity almost of lightning, and the insect or worm is drawn into the mouth. So quickly is this done that it requires careful observation to notice the movement at all. The ova are laid in double strings, and are thus to be distinguished from the ova of the Frog, which are laid in masses. The Toad hibernates in holes or under leaves. There is one at the present time hibernating in a hole which has been carefully selected in my garden, as it is just at the back of the wall of the kitchen and within reach of the warmth of the range. The tadpole stage is very similar to that of the Frog. The Toad is a good climber, and my friend, Mr. Standen, of Owen's College, Manchester, relates an instance of a Toad climbing up a whitewashed wall over 6 feet in height to its hole, but he was never able to see it descend, and how it accomplished the descent would be interesting to know. As to alleged instances of Toads having been found embedded in solid stone, many apparently true instances have been given, but that a Toad can have existed for hundreds of years in solid coal or stone without food I cannot believe, and the numerous experiments made by Dr. Buckland, in putting Toads in cells formed of different substances, have proved to the contrary. At the same time, no doubt Toads may have become imprisoned in holes of trees or in clefts of rocks, or even in holes of soft or porous stone, and have been there found surviving after months or even years of incarceration, but that is a very different thing. You have no doubt all heard of "Flint Jack," who made old stone implements, arrow heads, &c., and palmed them off to Archæologists as genuine; well in the same way a "Toad Jack," if I may call him so, started business in Leeds, and prepared for sale Toads said to have been found in blocks of coal, by baking the Toads until they were hard and black, and then by splitting a lump of coal and hollowing it out on each side, making the cell wherein the Toad was supposed to be found. Just one word as to the alleged poison glands at the back of a Toad's head. The question of poisonous or non-poisonous secretion has been the subject of much discussion recently both in the "Lancet" and the "Field" newspapers. The glands do contain a thick, yellow fluid, and Dr. Brunton's opinion is that "as a poison it does not appear to be particularly virulent when taken into the stomach of another animal, but injected into a wound, it is very active and causes ulceration, and mortification at the point where it is injected." Dr. John Davy on the other hand, inoculated chickens with this fluid without any resulting ill effect whatever, so as in this case Doctors seem to disagree, I will not presume to say more on the subject.

(7) *Triton Cristatus.* Common Warty Newt. Perfectly harmless little creatures are the Newts, but on account of their being commonly called "Askers" or "Evets," words which appear to imply everything that is evil and dangerous, they are dreaded by most persons, who have not taken the trouble to study natural objects. A Staffordshire Naturalist who was catching Newts for Aquaria, was once addressed by a Staffordshire rustic "What are you going to do with them? They tell me these 'ere varmint spit fearful pison!" It is, I fear, only a repetition of the old adage: "Give a dog a bad name, &c." This species is the largest of the British Newts, attaining to 6 inches in length, and it is of a blackish or yellowish brown, with darker round spots, and the sides minutely dotted with white. The under parts are bright reddish orange, giving this Amphibian an extremely handsome appearance. During the breeding season, the male acquires a deep flexible crest, extending along the back. This Newt is to be found in all our ponds and watery ditches during the spring and summer months, but hibernates like its other allied species. They are most interesting creatures to keep in an Aquarium, and I have often tamed them sufficiently to come for food when tapping on the glass. They periodically cast their skin, sometimes in one entire piece, coming off like a glove, even to the toes, and sometimes shelling off in pieces, and this cast-off skin is sometimes devoured by the late owner of it. The food consists of aquatic larvæ, beetles, and insects, and also fresh water molluscs, tadpoles, and the young of the smaller or smooth newt. The eggs are laid singly within the fold of a leaf of some aquatic plant, the development from the egg and through the various tadpole stages follows very much the same stages as in the life history of the frog; the Branchiæ or gills are however more fully developed and feathery, and form a beautiful object under the microscope, and being transparent, the circulation can be even more clearly seen than in the web of a Frog's foot. The Newts in case of the loss of the tail or any of the limbs, have power to reproduce the same.

We now come to the last of our local species:

(8) *Lissotriton punctatus.* The Smooth Newt. This is commonly called Eft, Effet, or Evet, an old Saxon word meaning Newt, or it has been said to be a corruption of the word Newt, thus Newt, Nevet, Evet, Eft. This is a smaller species than the last, not exceeding about four inches in length, and it may be distinguished by the smooth skin and by the crest of the male being continuous from the back of the neck to the tail. The male is brownish grey on the back, and yellow beneath, and the female a

light yellowish grey or buff. The metamorphoses of this species are similar to those of the Warty Newt. The young however sooner leave the water, and this is far more of a terrestrial species than the other, and may often be found under stones and logs of wood, in the autumn. The eye is specially bright. Bell says the growth is particularly rapid, and that this species attains the adult size the first year, but I have frequently found specimens late in the year only half-grown, but those may of course have been a late hatch. Now, I must bring my too lengthy paper to a close, and I feel deeply my deficiences in endeavouring to give you a sketch of our local British Reptiles. Time would not permit me to go fully into all those interesting details connected with the full life history of each species. My hope is to arouse an interest amongst our members in these despised, animals, which I am sure are most important factors in preserving us from the plague of injurious insects. In these days of technical instruction, what is more important to the farmer and the market gardener than to become acquainted with the full life history, habits and food of all the animals, as well as insects, which are likely to have a habitat on the land he is cultivating? I would appeal then to our members, especially ladies who have spare time to take up the study of our local reptiles about which comparatively little is yet known, and so much remains to be learnt. What has not Miss Eleanor Ormerod done for our farmers in tracing out the life history of injurious insects? and not only so but in ascertaining the best remedies, or at all events the best remedies *yet known*, for putting a stop to their ravages to our crops? Where can you get a better antidote for a plague of slugs in our strawberry beds than the Toad or the Blindworm? and yet the latter is ruthlessly killed whenever met with. Instruction is the order of the day, and therefore do not let our members be behind hand in spreading a knowledge of the usefulness of our wild animals and wild birds, and so not only preserving them for our own study and admiration, but also for the benefit of our agricultural neighbours. Why should not our Society take up a share of Technical instruction in Natural Science?

SECTION B.—ENTOMOLOGY.

CHAIRMAN.—THE REV. THOS. W. DALTRY.

REPORT 1891-92.

Of the seven species of Lepidoptera which have to be added to our North Staffordshire list only four are the result of last year's work. The other three ought to have been recorded long ago, but in some way they have been overlooked, and I think the reason of this is, that they were in the first instance mistaken for other species; with two of the three I know that this was the case.

The seven new species are :—

I.—Eriogaster lanestris.

II.—Eupithecia plumbeolata.

III.—Eupithecia minutata.

IV.—Lobophora viretata.

V.—Scotosia certata.

VI.—Cidaria miata.

VII.—Hypœna costæstrigalis.

Of these the first belongs to the order Nocturni; the next five all to the Geometræ; and the last is a Deltoid. Mr. Woodforde found a brood of the larvæ of E. lanestris last summer on a hawthorn hedge, near the Loggerheads, on the road from Drayton. The larvæ of this species feed in company under a web. The moth emerges in March: the cocoons should be placed in the full sunshine. The two Eupitheciæ and the Lobophora have long been known to me. E. plumbeolata I used to take at Swynnerton Old Park, just above Shelton-under-Harley, where its food plant, Melampyrum pratense happens to grow. It gets its specific name from its plain lead-coloured appearance. E. Minutata may readily

be obtained in August in its larval stage, by beating the flowers of Calluna vulgaris, on any of our heaths, and hence it gets its English name of "The Ling Pug." The larvæ are pink or flesh-coloured, and are very pretty. Of L. viretata, I took a single well-w rn specimen at the Burnt Woods many years ago, and placed it amongst my series of Eupisteria heparata; it was Mr. Earl who first saw the mistake, and by comparing it with an undoubted specimen of L. viretata, which I had taken at Barnwell Wold, in Northamptonshire, we at once saw its identity. One or two more specimens I have taken since in the same woods, and then L. viretata was dormant until the famous Excursion of Mr. Masefield's to the Bishop's Woods, on May 31st, 1890, when three specimens were taken, and Mr. Woodforde has taken others in the same locality since. This was considered a rare species, until a locality was discovered for it at Aston Park, near Birmingham, a few years ago, where it has been taken in abundance. The larvæ feed on the flowers of the holly, and the moths may be found in May, sitting on trunks and branches of that tree. Of S. certata Mr. Woodforde took last summer a specimen, flying at dusk, in a garden at Market Drayton, and in a fortnight's time he took a second in the same place. It is a barberry feeder, and no doubt there are bushes of the Berberis vulgata in the gardens round Drayton. I am not at all sure that the next species has a claim to be included in a North Staffordshire list, as the only two specimens Mr. Woodforde has seen were bred from larvæ dug at the roots of oak trees in Hawkestone Park, which must be seven miles away from the boundary of our county. I have very little doubt it will some day be found within our borders. It is a pretty green geometer, and the female moths hybernate. They are in some parts of the country found in abundance in the winter time in out-houses and in unoccupied rooms. The seventh of the new species belongs to the Deltoides. This is a small Order, consisting only of fourteen species, of which five have now occurred in North Staffordshire. H. costæ-strigalis was abundant at sugar in the Burnt Woods last August. Mr. Merrin, in the Lepidopterist's Calendar, gives the thyme as its food plant, but in the Burnt Woods it must be some other plant, as there is no wild thyme there.

Having thus disposed of the newly added species, I will, as usual, proceed to speak of other captures of the past season, which appear to be worthy of record.

Acherontia atropos.—The Death's Head Moth. Mr. Masefield reports the occurrence of one at Cheadle. It flew into a cottage window.

Sesia culiciformis.—This was noted in last year's report as a species new to the district on the strength of a capture at the Burnt Woods by Mr. Woodforde. His oldest son took a second specimen last summer in the same woods.

Sesia spheciformis.—Mr. Woodforde bred four from larvæ in sallow and birch shoots brought to him by wood cutters. So far as I know only three specimens of this rare clear wing have been previously taken in the district, all by Mr. Alfred Smith. I was present when he beat a pair out of Oak-scrubb in the Burnt Woods. The third he took on the wing at Craddock's Moss. This he very generously presented me with, and it still remains the type specimen in my cabinet. This moth is peculiar in having a whitish bar in the antennæ, just below the tip.

Sesia bembeciformis.—A large number of willow sticks were brought to Mr. Woodforde from the Burnt Woods district containing larvæ of this species, and he succeeded in getting about a dozen and a half moths from them. Eleven sticks he gave to me from which four imagines emerged. Many seem to perish in the pupa state, probably through the drying of the sticks after they are cut.

Nola cristulalis.—This little moth was not at all abundant at the Bishop's Woods: quite different from the previous year, when the Club visited these woods on May 31st, and found it on every oak tree.

Hemerophilia abruptaria.—A scarce moth in this district. I have only two notices of it, both at Madeley. Mr. Woodforde now adds a third from his garden at Market Drayton. The larvæ are on lilac, and on rose.

Geometra papilionaria.—I found a female of this fine moth, the large Emerald, on Wybunbury Moss. After being boxed she laid upwards of fifty eggs. Mr. Woodforde is endeavouring to winter the young larvæ at Market Drayton. They are sleeved on a growing birch tree.

Hyria auroraria.—We took two or three specimens of this beautiful little Geometer on Wybunbury Moss in 1875. Last summer Mr. Woodforde and I took nearly twenty in the same place on July 18th and 31st. Seventeen years had elapsed since the first captures.

Acidalia immutata—In the same year one of my sons took a single specimen at Wybunbury. A second was captured there by Mr. Woodforde on July 18th last.

Acidalia inornata.—The year 1875 added no less than 26 species to the North Staffordshire list. It was, no doubt, an excellent year for collecting. Several moths were taken, which have not been observed again until last season. Among them was this Acidalia. It was abundant at Swynnerton in the former year, and Mr. Woodforde found it in similar abundance last year at the Burnt Woods. The Rev. C. F. Thornewill took it also on Cannock Chase. Mr. Woodforde took it on the wing, and also more plentifully at sugar.

Hybernia aurantiara and Cheimatobia boreata.—These two late autumn species were plentiful in the Burnt Woods. The former is an oak feeder, and the latter feeds on birch. The imagines will be found on the trunks of their food trees early in November.

Larentia multistrigaria.—A single specimen was boxed near Drayton last spring. I have only taken it two or three times, once I well remember, off an oak tree at Swynnerton Old Park, and in 1883 I saw a specimen on a birch tree as I was driving to Whitmore. I do not know of any other captures in the neighbourhood, but I think it must be plentiful, as its food plant, Galium sexatile, is common enough on our heaths It wants searching for at dusk and by lamp light.

Emmelesia affinitata.—The larvæ of which feed on the capsules of Lychnis dioica abounded in the Burnt Woods last year. I have seen it in similar abundance, in company with E. decolorata, which feeds in the same manner amongst their food plant in the Hay Sprink, Madeley.

Eupithecia indigata.—This Scotch Fir feeding Pug we took at Craddock's Moss on June 6th in excellent condition.

Lobophora hexapterata was as abundant on aspen in the Bishop's Wood this year, as we found it last year, when it was added to the list.

Ypsipetes ruberata.—This is another species, which has only been taken three or four times, and always hitherto at the further end of Chorlton Moss, where there used to be some willow trees, which

have been cut down recently. Mr. Woodforde took a larva off willow at Betton Moss, which last spring proved to be this species: it seems to be by no means common here.

Melanippe galiata.—Mr. Ernest Blagg took a specimen last summer at Cheadle Park Wood. This species was first recorded two years ago on the strength of a capture by the same collector on the Derbyshire side of the Dove. This second specimen proves the species to belong undoubtedly to our district.

Carsia imbutata.—This pretty little Northern Geometer, the larvæ of which feed on the Cranberry, was fairly plentiful at Wybunbury last August.

Phibalapteryx lignata swarmed at Betton Moss. Mr. Jahn used to take this fenny species at the gas lamps outside Stoke.

Cidaria ribesiaria.—This Currant feeder was plentiful last summer in a garden at Drayton. Although a common insect I have never taken it at Madeley. It was recorded in our first list by Mr. L. H. Jahn, as occurring at Stoke, and I do not know that it has been seen since. I have no doubt this is accidental: from the prevalence of the food plant it must be general, although probably more plentiful in some seasons than in others.

Dicranura bicuspis.—A female was taken at Cannock Chase by Mr. E. D. Bostock. Hitherto the only locality, in which it has been taken, is Chorlton Moss, whence I have three specimens, and a friend obtained a fourth. Mr. Woodforde claims that he took two larvæ of this rare species at Wybunbury, last August, from alder.

Notodonta dictæa.—Mr. Woodforde has bred a specimen. The larvæ of this "prominent" has been of late taken in numbers at Cannock Chase by Mr. Thornewill and others from young poplar trees.

Thyatira batis.—Two specimens of this lovely moth, "the Peach Blossom," were taken at sugar, in the Burnt Woods, by Mr. Woodforde.

Cymatophora duplaris.—This was also taken in the Burnt Woods. Mr. Thornewill and Mr. G. Baker have each bred a very dark and

handsome variety of this species from larvæ taken at Cannock Chase, and they are disposed to think that all the Cannock Chase specimens are abnormally dark.

Acronycta leporina.—A specimen was taken at sugar at the Burnt Woods.

Hydrœcia micacea.—Two or three were taken from lamps at Drayton.

Miana fasciuncula.—A specimen at sugar in the Burnt Woods. This is a garden species. I have often taken it at Madeley.

Celœna Haworthii.—We saw several moths flying wildly at Wybunbury last September, but captured none. A dead one was found in a spider's web.

Tryphœna fimbria.—This grand yellow Underwing was taken at Burnt Woods in all its varieties. Mr. Woodforde also bred a specimen.

Noctua Dahlii, Noctua Umbrosa, Noctua Neglecta, Orthosia suspecta.—These four moths are by no means common, but they all occurred abundantly last August at the Burnt Woods. N. neglecta varied in colour from brick red to grey, and some were pale yellow, a most unusual variety, perhaps peculiar to North Staffordshire. One deserves special mention: it is deeper in colour, almost tawny, like a male E. Russula or an E. Fulvago. It is a lovely insect. and probably unique. O. suspecta was as abundant as it was at Swynnerton Old Park in the year 1875, the only year in which I met with it. It, too varies a good deal, from a purplish red to brown with ochreous markings. A few specimens were also found on Cannock Chase. A paragraph concerning these moths will be found in this month's number (March, 1892,) of "the Entomologist."

Xanthia citrago.—Mr. Masefield took an imago at Cheadle, and Mr. Thornewill several larvæ at Repton Shrubs off lime, from which he bred the perfect insect.

Epunda viminalis came to sugar in the Burnt Woods, and the larvæ were abundant there in leaves of sallow.

Aplecta tincta.—This beautiful moth was abundant at sugar in June in the Burnt Woods.

Hadena glauca.—At Craddock's Moss, on June 6th, a freshly emerged specimen was picked up.

Hadena adusta.—This species was first recorded last year. Mr. Woodforde has again taken a specimen at sugar at the Burnt Woods.

Cloantha solidaginis was most abundant at the Burnt Woods This moth may readily be taken both by day and night: by day at rest on the tree trunks and on heather stems, and by night at sugar. It is certainly a much more plentiful moth than it used to be.

Abrostola triplasia —Mr. Woodforde took a specimen. This has always been an uncommon species in this district.

Euclidia glyphica.—One at Betton Moss. I once took this species in a railway cutting near Madeley, and I never saw it elsewhere in this district.

Schrankia turfosalis.—This little Deltoid was abundant on Wybunbury Moss. Owing to the absence of sunshine it was flying all afternoon. It is a frail little insect, and soon dies in confinement.

Pyralis farinalis.—Mr. Woodforde and I renewed our series of this "stable" moth (it feeds on meal, &c.) at Wybunbury.

Crambus margaritellus, Tortrix viburnana, Mixodia schulziana. These were all abundant at Wybunbury.

Phoxopteryx myrtillana.—One on June 6th, at Craddock's Moss. It is a plentiful insect on the bilberry later.

Grapholita paykulliana, Pœdisca bilunaria.—These were both taken at Wybunbury.

Eupœcilia angustana was abundant there, as indeed is it on all our heaths.

Glyphiptoryx fuscoviridella.—A single specimen of this glittering little Tinea was taken at Wybunbury.

Pterophorus plagiodactylus.—Several specimens of this not uncommon plume were taken at the same place.

Such is the record of the Section. Not a bad one when it is remembered that only one Entomologist did any real work. But for Mr. Woodforde of Market Drayton, our report would have been indeed a meagre one. It is much to be wished that some of our members would take the subject up. It is a most fascinating one, and there is much yet to be learnt of the Lepidoptera of this district. I cannot doubt many new species may yet be added. The collecting ground is a good one, both on the West side and on the East. On the former we have large heathy woods of Oak and Scotch Fir, and on the East we have the warm limestone of the Manifold and Dovedale valleys. All over the district we have large mosses, and meres and ponds, and to the North-east extensive moorlands. Such a varied district cannot but be a productive one, if it was only worked, as it deserves to be. And it must never be forgotten, that to our shame we must confess, that with the exception of the Lepidoptera and Hymenoptera, the other orders of insects have not been attempted at all by any of our members past or present. I wish two or three would undertake the North Staffordshire Coleoptera. It is a big task, no doubt, but Canon Fowler's new and most exhaustive work on this order will, for the future, make the work of identification comparatively easy. This Sectional Report cannot conclude better, than by strongly recommending this most interesting order to the attention of our younger members.

REMARKS ON APIS MELLIFICA, THE HIVE BEE.

By Captain T. J. Smith.

(Read January 23rd, 1892.)

From the earliest of the world's entomological history man has, in prose and verse, asked the question "How doth the little busy bee," and has sought to answer it according to the light and leading of his period. The writers refer to bees, or their products honey and wax, in about a score of the Old Testament books, and the ancient Egyptians recorded their knowledge on tombs and pyramids in their own peculiarly artistic hieroglyphics. How primitive man in search of the necessaries of life may by chance, from time to time, have discovered the hollowed tree containing honey is easier to imagine than their mode of obtaining it from the bees. But doubtless the ingenuity of the man who had to hunt and fish for his living and obtain supplies or starve, would be equal to such an emergency. Honey, perhaps their greatest luxury, much desired would be much sought, how, perhaps, may be best seen by the modes of modern savages. In North America bee hunters put a bait of honey on a flat stone and surround it with a ring of thick white paint, across which the bee crawls to take flight from the edge of the stone, and at once marks and clogs itself, and can therefore only fly slowly and may be followed. The Australian's practice is rather more ingenious. The hunter catches a bee, and gums a piece of down upon it. The bee can fly but very slowly, and is followed home and the honey taken. Aristotle is credited with being the first of those, who, in these latter days, are called scientific bee-keepers, and under the bounty of his pupil, the great Alexander, was able to carry on his investigations most successfully. Some three hundred years after Aristotle made his observations Virgil wrote his fourth

Georgic which gives a good idea of bee knowledge, clothed in poetic imagery. The following description of an Italian queen bee is in the Virgilian style—

Glowing with yellow scales and dazzling hue,
Her body marked with golden bands we view ;
If safe, this queen one mind abides in all—
If lost, in discord dire and feuds they fall ;
Destroy their work, waste all their gathered store,
Dissolve all bonds, nor are a nation more.

If she but live, ruling the glowing hive
All are content, the fertile race survive.
Her they admire, with joyful hum surround,
While labour thrives and honeyed sweets abound.

Some two years ago in conversation with the adjutant of a battalion of Staffordshire Volunteers we remarked upon a new drill and upon the tactics of a new mode of attack. Quite as a pleasantry I observed that a few hives of bees might at intervals be kicked over some distance in front of the position of defence, for through such a line the men attacking would have difficulty in keeping any proper formation. He smiled, and possibly has forgotten my novel and very original suggestion.

As their is nothing new under the sun, to indulge in the thought of any suggestion being novel and original is extremely dangerous: but in connection with the subject of bees and bee-keeping the idea must be banished. One of my latest proofs of this came a few days ago when looking into the "History of Herodotus" I found on page 454 that in writing of the Thracians, he says—"To have punctures on their skin is with them a mark of nobility, to be without these is a testimony of mean descent; the most honourable life with them is a life of indolence, the most contemptible that of an husbandman. Their supreme delight is in war and plunder." And on the next page but one he states, "The Thracians affirm that the places beyond the Ister (the Danube) are wholly possessed of bees, and that a passage beyond this is impracticable." Plutarch has referred to the bee as a "magazine of virtues." Virgil says "that the bee is a ray of divinity;" De Montfort, "That the bee surpasses in architecture the skill of Archimedes;" Quintilian has referred to it as "the chief of geometricians;" and you will remember that this worthy master of eloquence in the Roman State—he who was called "The Glory of the Roman Gown"—quoting the curious old preface, to my copy, by the Translator to the Reader, "had *several Youths committed* to *his* Education *and* Care: *To* those *who were of the* Supream Class, *and had attained to some* ripeness of reason *and* understanding, *he was* wont to *propound* Subjects, fictitious *or* real, *for them to* exercise *their* Wits *upon Pro* and *Con*

in vocal *Orations : which being done, he* selected *the most* nervous *Arguments and* florid *Expressions out of all* their *speeches which he* afterwards lick'd *over into one* terse *and* polite discourse *here called* a Declamation. *I mention this as an* encouragement *to the* Ingenious *to peruse these* Orations, *in regard they are the* cream and product *of the most* promising *Wits, culled out and* polished *by the* Second *hand of the* Master."

Declamations xiii is upon *Apes Pauperis,* or, The *Poor Man's* Bees, and the following is *The Argument*—The Law *allows an* Action *of the case (as they call it) for a* damage *wrongfully* sustained. *There was a* Poor *Man and a* Rich *in the* Country *that were* near *Neighbours so that their* Gardens *adjoined* one *to t'other. The* Rich *man had* Flowers *in his* Garden, *the* Poor *Man had a* Stock of Bees. *The* Rich Neighbour *complain'd that his* Flowers *were* nip't *and* injured *by the* Poor *Man's* Bees, *whereupon he gave him* Order *to* remove *them. The* Poor *Man not being* willing *so to do, what do's the* Rich *but* sprinkle over all *his* Flowers *with* plain Poyson. *So that the* Poor *Man's* Bees *were* all kill'd. *The* Poor *Man* impleads *the* Rich *in an* Action of Damage *for doing him so* much Wrong"

Now I venture to think that I have sufficiently quoted from the writers of antiquity, and that the resultant in your minds is that the common hive bee is a most highly respectable insect. No one could for a moment doubt that if I only mention it as *Apis Mellifica,* that lesson I learnt at our greatest of Stoke Meetings. It was in the Town Hall. That evening I was in the 'brass and glass' department, and we had a splendid show. Magnificient and rare objects were being shown in abundance. In anticipation all members had worked with one common desire to make the meeting a success. I, myself, had spent much time in pond hunting, and was in state of desperation because of my ill luck. I, therefore, went to the meeting with nothing but common place subjects, and much disappointment. However, after trying this and that, I commanded success with *pulex irritans.* Said a lady to her companion, Oh do come and look at this! What a charming creature! It is truly beautiful! Can you, she said, addressing me, tell me what the name of this is. I replied, yes. *Pulex irritans.* Oh thank you, it is really very beautiful. Otherwise, I added, after a slight pause, *the common bed flea.* I shall never forget her jump from the instrument with a look of disgust. But she recovered splendidly—well, she said, it is the very first time I have ever admired it, the disgusting creature. 'A rose under another name may smell as sweet,' but this law is not universal. *Pulex irritans* is a delightfully beautiful organism, but the flea is a disgusting creature.

Apis Mellifica is perfectly charming, and I trust '*that nasty stinging bee*' may, by at least all here, be considered equally beautiful when its economy and character have received our consideration.

The leader then gave an interesting scientific account of the embryology and transformations of the worker, the drone and the queen, their respective physiology and functions, the preparation of their food stuffs, modes of work, and social division by swarming. He referred to the wondrous nerve system, and recommended that those who desired to pursue the study should obtain Mr. Cheshire's great work on "Bees and Beekeeping," a copy of which is in the Nicholson Institute library; and to remember that in all scientific knowledge there is but comparatively little that is definite, and nothing that is ultimate. Continuing, he remarked that particularly to members of our club the part that bees take in the fertilization and cross fertilization of flowers is worthy of attention. By the microscopic examination of the pollen from a hive it may be seen where the bees have been, and what they have been doing. To watch their flight is always interesting. From the darkness of the hive they come into the strong sunlight, and from the entrance spring off, take circular flight, and dart off at the rate of some score of miles an hour on their business bent.

Here it is necessary to caution the tyro. The hive bee will not tolerate any interferance when on a strictly business journey at a time when there is much work to be done, and the person once stung will remember the sensations for some considerable time. The exhibitions and manipulations at our agricultural shows have done a vast amount of good by imparting a thoroughly practical knowledge, but they have also tended to cast doubts into the minds of young beekeepers upon the necessity for protecting themselves against the stings. Taught to bear the sting and that you have only to be stung often enough to become inured:—well, I have heard a similar argument in favour of hanging. I asked a 'bee' expert how long on the average it would be before a person became inured, as he appeared to be. He said about three years. I tried it, even went so far as to make the bees sting me, for the sake of the inoculation. To some extent I became inured, the part does not swell to so great an extent, neither do I think so much of being stung, but this may be the result also of my knowing what I may do and what I may not do with bees. I have been stung hundreds of times. A sting is always painful, and the swelling that follows is usually anything but an improvement to one's personal appearance. Once I was really badly stung. Taking honey without the

protection of veil or gloves, I was a tyro and something of an enthusiast—the morning a beautiful one for the purpose, warm and plenty of sunshine. I was stung in three places on the head and the sensations were remarkable. I felt myself becoming greatly excited, and swelling to enormous proportions; out of my throat there seemed to come fumes the taste of which is known to all those who have smelt bees in a state of agitation say during the operation of driving them out of one straw skep into another. I hurried into the house and just arrived in a passage where there happened to be a current of cold air in time to prevent a faint. I was fearfully giddy, with eyes terribly bloodshot; I felt that unless something were done I should die. The perspiration steamed out of every pore. A cold bandage to the head was most beneficial, and this was renewed from time to time until I went very cold then I was wrapt up in rugs until I was warm again and almost right. From the stinging to recovery only occupied about an hour. In mentioning this experience to a medical friend, also a beekeeper, he gave it as his opinion that I had been stung on a vein, the poison, which you know is formic acid, being taken at once into the circulation produced symptoms similar to snakebite, and was thrown out by the strong effort of nature in the perspiration. Hence it is that very weakly persons if stung are in more danger than the stronger, because they have not the power of throwing off the poison. Well, but you, like me, will desire to know what in the event of such stinging should be done. The doctor's advice was 'Take a good glass of whiskey, sal volatile will do, or brandy, but whiskey is the best, and let it be a stiff one.' If you should happen to be a teetotaller never mind, don't hesitate, take the whiskey for the sake of yourself or your friends, and remember that although some dilution will be necessary, it must not be what is known as homeopathic. As a rule bees won't sting unless you provoke them by meddling with them or taking their stores. If, however, one should happen to alight upon your nose, which is not an uncommon occurrence near an apiary, just leave it alone, walk away from the hive and it will take its flight as innocently as it alighted. Your inclination will be to knock it off. Don't, for the combat is unequal, and you will come off second best.

I have been sufficiently curious to want to know how it is that bees know where to go for honey and pollen. If you keep bees and have a garden, it is interesting to have some early flowering plants such as arabis, but really all the flowers you may have availeth little. The honey is obtained principally from the fields, and the necessity is per acre rather than per rood. The foraging bee comes home laden. Has she to go out and re-discover that honey

or pollen-giving tree or field, or does she remember the way, or are her senses of sight and smell sufficient to prevent her going in the wrong direction? And if so, do the other bees find out by individual discovery and the uses of the senses of smell and sight similarly, where they can find stores, or can the bees convey information by language? Well, if you notice carefully, you will find that the bees from a given hive fly more in one direction than another, and it is not uncommon to see one hive extremely busy, and the others idle. Further that bees don't fly in Indian file closed up with the rear bees conforming to the direction of those in advance, they act individually, but with the same intent. Now, choose a day when the bees are not busy, but such a day when they are willing to do a little business near home. Take a little honey and crushed comb —say from a partly filled super—spread this upon a plate, and put it a couple of dozen yards away from the apiary, and watch. At first a foraging bee finds out the store, fills up and flies off. In a few minutes there may be half-a-dozen bees filling, then there are more. With the cook's flour dredger whiten the bees on the plate, and go off to the apiary and see into which hive the bees go. In a short time the plate will be covered with bees, dredge them and you will find that they are going into, possibly, one hive, unless, perchance, foragers from other hives have also found out the store.

This experiment goes only some way towards proving that the store-discovering bee has, by language somehow, made known the locality; and is insufficient to prevent the thought that it is by leading or smell and not by language that the store is made known. We have seen that it cannot be by a scented track, therefore I took some honey from a hive with some bees upon the comb, and carried bees and comb through my garden to my house, and brushed off the bees through the open scullery window, and then closed the window. Shortly for that honey came numbers of other bees, some battering themselves against the window panes, and others making an invasion through the door through which the comb and bees were taken. Thus it is clear that other bees had the locality of the stolen stores made known to them, but still no proof of a language.

A few days afterwards I repeated the experiment so far as taking the honey comb and bees up the same path, through the same door into the scullery, but this time taking care that not a single bee escaped. I at once killed them all. What was the result? Not a single bee came for that honey. Why? The only explanation I can give is that the bees in the hive were ignorant of the locality of the stolen stores, because they were not told in

bee language where it had been taken to. I say bee language advisedly. Every beekeeper knows something of that language. Mr. Pettigrew, who lived near Manchester, a most practical beemaster, asked the question years ago, and replied to it with a decided affirmative. "Yes, bees have a language. Where is the beekeeper of intelligence who does not know the hum of contentment and the hum of trouble—the hum of peace and the hum of defence—the hum of plenty and the buzz of starvation—the hum of joy and the roar of grief—the cry of pain and the music of their dance—the buzz of the heavy laden and the scream of suffocation." The cry of pain from a bee at the door of a hive affects the whole community. Where is the beekeeper who is not acquainted with the sound of bees bent on mischief—they have not stung him but he knows they mean it, and he clears off if unprotected. I must confess that even this "bizz" has less effect upon me than that horrible "squeal" which a bee gives forth, and by which the beekeeper knows that in replacing the carpet covering over the frames in his hive he has accidently crushed a bee.

I am aware that Sir John Lubbock's experiment with tuning forks, whistles, and violins is commonly regarded as proof that bees are deaf. As it appeared otherwise to Mr. Cheshire, the most original investigator of modern days, he communicated with Sir John, who informed him that his (Sir John's) position was negative, as he merely failed to get evidence of bees hearing. Mr. Cheshire remarks upon this—"That should some alien being watch humanity during a thunderstorm, he might quite similarly decide, that thunder was to us inaudible. Clap might follow clap without securing any external sign of recognition; yet let a little child with tiny voice but shriek for help, and all would at once be awakened into activity. So with the bee; sounds appealing to its instincts meet with a ready response, while others evoke no wasted emotion." But let us assume total deafness. Cannot humaners who are deaf aye, and dumb, too speak? and is it not also well known to us that our primitive forefathers had only a gesture language? I see nothing inconsistent in the belief that either by gesture or by sound, or partly both, which is our style, bees have a language. But a language cannot be of use unless there is also a sense of thought. That bees have brains is without doubt. The brain is described by Mr. Cheshire, who has followed Dujardin, an eminent French physiologist, as soft and transparent, but with the assistance of a hardening agent, the convolutions may be easily traced, which, for ought we know, may preside over their respective limbs and actions. The cerebral mass is made up of transparent globules from 1-3000th to 1-5000th of an inch in diameter.

The size of the brain is also a gauge of intelligence. In the worker bee the brain is 1-175th of the body, in the red ant 1-296th, the cockchafer 1-3500th, and in the *Dytiscus* beetle 1-4400th; hence by this standard the bee is nearly twice as intelligent as the ant, upwards of twenty times as intelligent as the cockchafer, and has more than twenty-five times the brain power of the other intelligent insect— the *Dytiscus* beetle. It is also clear that the size of the brain in the queen bee, and the drone is much smaller than the worker—those amazons who support the political fabric of the bee-hive, supply its food, bring up the young, furnish its architecture, defend its property, administer justice, and determine the how, the when, and the where of new colonies require greater endowments than the males and true female, who is largely abortive, so as to be almost exclusively limited to the faculty of reproduction.

With the organ of intelligence very largely developed, we Field Naturalists look for intelligence rather than what the majority would prefer to call instinct. Call it what you will, I have seen a higher intelligence displayed by bees than by many a human being, who would as a matter of course be credited with reason. Whoever saw *un*intelligent man or woman in a crowded room form a fresh air bearing company, fanning from the open, one to another at intervals, as firemen pass buckets of water—until the air in the room is at a proper temperature and purified? Bees do it cas a matter of course, daily and nightly. But comparisons, and esperially such comparisons, are odious, and I will pursue them no futher Break a comb across the top and let it fall to the floor of the hive, the bees will build down to the fallen portion, and then make a doorway through the bottom to enable them to reach the other combs. Loosen a comb from a frame, the bees will fasten it. Leave an aperture other than an entrance, and if large, the bees will build it up with wax; if too small, but still large enough to allow the escape of necessary heat, they will seal it up with another product like resin called propolis. Put a comb into the hive which has dead bees or dirt in the cells, the bees will at once clear it out of the hive, flying off with the dead or *debris* some yards away.

Our excellent friend, Mr. W. Carr, whose absence I particularly regret, as he is an old authority on the hive bee, showed me a newspaper cutting a few weeks ago, which had been sent to him by a Leek lady. The paragraph states that "two bees were observed to issue from a hive bearing between them the body of a comrade, with which they flew for a distance of ten yards. Then with great care they put it down, and selected a convenient hole at the side

of the gravel walk to which they tenderly committed the body head downwards, and then afterwards pushed against it two little stones, doubtless *in memoriam.* Their task being ended they paused about a minute, perhaps to drop over the grave of their friend a sympathetic tear, and then flew away." If the writer had only allowed a little greater latitude to his fanciful imagination, and thrown in a band humming in slow time the Dead March in *Saul,* the firing of three volleys over the grave, as well as the sympathising tear into it, he would have only taken one more step towards *ad absurdum* about which in the present and the future there could possibly be no mistake. Without doubt bees are remarkable sanitarians, but, as in other cases, it is difficult to say where instinct ends and reason begins.

All that I have mentioned as being done by bees may be attributed to an unerring instinct because it happens constantly, Combs often broken—instinct displayed in self-preservation may be the impulse by which they are repaired; but on one occasion I had the misfortune during a manipulation to let a couple of newly-made and brittle combs filled by the bees with sugar syrup, and too heavy to be safely lifted out of the hive, fall into it. One part stood upright, and the bees fastened it to the sides of the hive by comb building—this by a little more than ordinary instinct. But what of the remainder? That being in a jumble could not be instinctively dealt with. They salved every portion of it that could be carried away and stored or otherwise made use of in other parts of the hive The ingenuity displayed in the work struck me as most wonderful, and caused me to recognise the reasonable intelligence which prompted them to do at once the best thing possible upon exceptional circumstances. When the grass is cut for hay and the inflow of honey almost ceases, their sense of morbid self-interest asserts itself. They then act pretty much as stall holders do on the second day of a three day bazaar, when there is nothing else to prey upon, they prey upon each other. Every nook and cranny is examined by the bees of one hive for a weak point in another hive, and if an entrance can only be effected the stores are stolen, and those bees of the weak stock that are not killed in the combats during the invasion are left to starve The intelligent bee-keeper knows that his only safeguard is in keeping his stocks strong. A weak stock is not only lost, but the victors flushed with their success next attack a stronger, and brave as lions the combats are fought out without quarter, until perhaps a valuable apiary is well nigh ruined. Lessons from the hive in moral as well as natural philosophy have been given in all nations sufficiently civilized to formulate and receive them.

We, who are Field Naturalists because we love Nature, and desire to know more about her, ought to sensibly feel the full importance of Nature's teaching. We are members of a club that we may the more fully and efficiently do so. We are also citizens of a wealthy empire under one beloved Queen. Upon our foragers the sun never sets. Our hive is filled with stores of wealth, which the envious of other nations would make their own. The strength or weakness of our forces are known to them as well or better than the strength or weakness of their forces are known to us. When next the thoughtless would charm you soothingly into the belief that there is a benign and heaven sent philanthrophy between the nations of the earth, and that the forces of self-interest and national jealousy are of the past, think of the bees, and in the truest spirit renew the question, "How doth the little busy bee?" and according to your light and leading give forth your answer.

SECTION C.—BOTANY.

CHAIRMAN.—MR. YATES.

REPORT FOR 1891-92.

In presenting my last Botanical Report to the Field Naturalists' Club, I am sorry to have to claim a little indulgence, owing to the fact that I have lost my notes during my removal from Newcastle. However, my friends have supplied me with notes and observations of their own.

Last year was a bad year for the Botanist, as the almost continual fall of rain during the summer prevented much research in the fields.

It will be recollected that the Rev. W. W. H. Painter had a Botanical paper read for him at our meeting at Hanley, from which I am glad to cull a few interesting particulars. Mr. Painter found Equisetum Maximum or Telmateia, at Knypersley—a find that pleased him much—though this plant is widely spread over England, yet Mr. Garner has not recorded its presence in Staffordshire. It is often four or five feet high.

He calls to mind a marked variety of Cardamine Hirsuta. It is much larger than the ordinary species, has six stamens instead of four, and has spreading pods. It is tolerably common in the neighbourhood of Newcastle, it is called Cardamine Flexuosa, by Withering; Cardamine Sylvatica, by Bentham. Montia Rivularis, a variety of M. Fontana, is met with at Rudyard.

It is well known Mr. Painter has made a special study of the Brambles, which has led him to divide them into many species. Most Botanists, however, only recognise about five distinct species in England. In Babbington's Manual 40 species are distinguished.

As soon as the observant Botanist has exhausted his local flora he will begin to find pleasure in recognising and identifying varieties which diverge so much from the ordinary type that he is induced to regard them as distinct species. Mr. Painter has observed no less than fourteen well-marked varieties in the neighbourhood of Knypersley. Amongst the number is Rubus Fuscus. This is truly a Moorland plant, it stands perfectly upright, with many barren stems, which will become the fertile branches of the next year. R. Lindleyanus may be known by its large open panicle of white flowers, and by its naked purple varnished stem. Mr. Painter has noticed Crepis Paludosa in two places at Rudyard, and at the Lion's Paw wood on the banks of the Trent. This is the plant Mr. Hurley discovered at Acton two or three years ago. Mr. Pointon has noticed two varieties of the wild crab, one with and the other without hairy petioles and peduncles, hence called Pyrus Acuta, and — Mitis. He also noticed Rosa Canina with spherical fruit instead of oval.

I have received some interesting observations from Mr. Daltry, showing the influence of weather on the duration of the flowering of plants, thus Snowdrops, owing to the absence of rain during the early part of the year continued in flower for two months, some were not quite over at the beginning of April. On the other hand owing to the hard weather of December and January, Crocuses did not get into bloom until April, and only lasted until about April 19th. At the same date (April 19th) Daffodils were out in the fields, also Hyacinths in sheltered spots. On May 10th Plums and Pears were in full blossom, Hyacinths and garden Daffodils had ceased to bloom. Oct. 29th, Dahlias and Begonias, etc., were cut down by frost fully a month later than usual, as it were to compensate for the late date at which they began to flower. In two years out of three, these flowers are cut down at Madeley about Sept. 25th. I consider these observations on the influence of weather as a very useful record—a record which has been very little attended to in this neighbourhood.

All three specimens of Drosera (Rotundifolia, Longifolia, and Anglica,) were discovered growing near together at Wybunbury Moss during last Autumn. Specimens were exhibited by Mr. Daltry at the Hanley Meeting.

A new habitat for the beautiful blue-streaked Wood Vetch (Vicia Sylvatica) was found last year near Madeley Vicarage.

Mr. Daltry also called my attention to the male catkins of the

Cedar of Lebanon, a specimen of which grows in Madeley village. The Botanical authorities say the anthers develop and shed their pollen in March or April, but as we found in October many of the anther cases empty and the pollen shed on the leaves, I wrote to Mr. Collins, of Trentham, for information. He kindly sent me specimens of a closely-allied species, Cedrus atlantica, the cedar of Mount Atlas, in Algeria, in which the pollen was already shed, and he informed me that the Cedars complete the fertilization-process in autumn.

Cladium Mariscus and Typha Angustifolia were found in abundance at Wybunbury, but they never flower very freely there.

Mr. Masefield and Mr. W. E. D. Bostock found Ranunculus Circinatus—a marked variety of R. Aquatilis—and Potamogeton Filiformis, in Copmere Pool. He also states that one of the rarest species of Carex—Carex Ornithopoda—was found in Miller's Dale, Derbyshire, last year. Previously in was deemed to be confined to Scotland.

The only fresh grass I observed last year was found during our Excursion along the "Ship Canal." It is called Sclerochloa Procumbeus or Poa Procumbeus, all the spikelets are turned towards one side of the branches.

In reading the life of Charles Darwin by his son, I was pleased and amused to read the following passage, (Vol. 2, p. 59), in a letter to Mr. Hooker, (now Sir J. Hooker). He wrote, "I have just made out my first grass. Hurrah! Hurrah! I must confess that fortune favours the bold, for as good luck would have it, it was the easy sweet-scented vernal grass, Anthoxanthum Odoratum, nevertheless, it is a great discovery. I never expected to make out a grass in all my life; so, hurrah! It has done my stomach surprising good."

Now, as Mr. Darwin was turned 46 when he made out his first grass, it is a great encouragement to anyone who may direct his attention to Botany, or to any other branch of Science, late in life. Only let him share the zeal and enthusiasm of Mr. Darwin, and there is no knowing what great discoveries he may make in the Flora, or in the Fauna of Staffordshire. And if his jaded stomach derives surprising good from his studies, the Spirit of Research will be greatly strengthened.

BOTANY AS A SCIENCE AND A RECREATION,

WITH NOTES UPON THE PLANTS IN BIDDULPH, &c.

By the Rev. W. HUNT PAINTER.

(Read November 18th, 1891.)

Such is the title of the brief paper which will be read to you this evening, the object of which may be stated in a few words, namely, to enlist the interest of the members of the Field Club in the study of Botany, both as a science and a recreation, and to awaken some zeal in their minds in the pursuit of this branch of Natural History.

Botany what is it? It is the study of plants. Now, this study may be divided into two parts: Structural Botany and Field Botany. Structural Botany, the study of the structure of plants, viz., their internal economy the duties of their various members, and the relation of one part of a plant to another, is undoubtedly a useful part of botanical study; but it has this disadvantage connected with it—that it cannot be properly pursued without the aid of a microscope. But if the student is fortunate enough to possess such an instrument, or to have access to one, then secrets are unfolded to him which are hidden from others, and he is permitted to gaze upon a combination of contrivances for the support and propagation of a plant, that only Infinite Wisdom could have planned, and Infinite Power could have carried out But I have spoken of Field Botany, and it is of this I wish to speak more at length this evening. as I have more interest in this branch of botanical study than in the one to which I have briefly alluded.

Now what is Field Botany? Viewed from one aspect it is the collection of plants. Once, when at Buxton, I made inquiries if a Botanist was to be found there, and I was informed that a Botanist lived in a certain row of houses. But when I arrived at his house and asked him a few questions, I discovered that he was only a medical botanist—a Herbalist. Undoubtedly it is a good thing to know something about the medicinal properties of plants, and the possession of such knowledge may be useful, as the members of the faculty of medicine present will doubtless own, but still, a Herbalist is not necessarily a Botanist.

Let us then inquire why a Botanist collects plants. He will collect them in the first place to examine them. The place to which each plant belongs, its genus, and its species, can only be properly ascertained by examination, by dissecting it; examining how its stamens and pistils are placed and their number, the arrangement of its petals and sepals; what is called the floral envelope. And this examination, as well as that of its seed—or as it is technically called, its fruit—is by no means difficult. All that is needed for this is a sharp knife, a small pair of scissors, a pair of small forceps, and a botanical lens, whilst a tin box or vasculum is also required in which to place the plants as they are collected. And whilst upon this latter subject I would remind my hearers that most important results have followed upon the use of most common instruments, many a successful Botanist having commenced by placing his spoils in a common candle-box.

In the next place, the Field Botanist collects and dries his specimens as vouchers of the plants that he has met with in his rambles. They are not only useful for this purpose—each plant having been carefully labelled with its name, habitat, altitude, and the date upon which it was gathered—but also in the case of the more critical species and varieties, for comparison, differences between the species and varieties being sometimes more easily detected by sight than by reading the descriptions of them contained in Botanical Manuals.

But these are not the only purposes which preserved specimens serve. They are memorials of the past. They bring before us pleasant rambles which we had with old friends who are no longer upon earth. They remind us of conversations which we had with those whose opinions we valued. They recall beautiful scenery which we have not seen since we plucked the flower we are now gazing upon. Or they remind us of dangers escaped, of perils from which we have been preserved by a merciful protecting God, dangers

and perils which might have entailed the loss of a limb, if not of life itself. Cold, indeed must be that heart which does not glow with thankfulness as the memorials of the Lord's abounding loving-kindness are thus beheld; and insensible to the goodness of the Lord must that heart indeed be, if a place for gratitude towards Him is not found therein!

We will suppose that a Botanist finds himself located in part of a county wherein no fellow-scientist has worked. What, then, does he do? If he arrives there at the close of the autumn or beginning of winter, his first care is to examine his locality, and to ascertain what lanes and field walks there are within two or three miles of his house. Next, he examines the Geology of his neighbourhood, that he may ascertain what is the nature of the soil upon which the plants grow—a very important consideration—as the soils of some geological formations, such as the Carboniferous Limestone and the Cretaceous produce rich floras, whilst the Coal-measures have a poor one. Having informed himself upon these points, he sets to work in the spring to ascertain what plants are to be met with in his district, working outwards from his home until he reaches a distance of five miles. These plants he carefully records in his note-book, and labels when he places them upon their sheets when dried And whilst upon this point I would strongly urge young Botanists not to trust their memories too much. When a multitude of facts have to be remembered, and each in its right place, it is very likely that they will jostle one another in such a way that the memory will be confused, and a set of facts will be found occupying the wrong place; and, therefore, I would earnestly advise all who desire to obtain a reputation for making accurate observations, to record their facts as quickly as possible whilst the memory is fresh.

It is very interesting at the close of one's first season in a fresh home to go over the botanical record, and to compare one's gatherings there with one's former gatherings, and to see how the difference in the geology of the neighbourhood, its height above the sea level, and the configuration of the country, the hills, valleys, etc., have affected the flora of that part of Britain as compared with another. For instance, to compare for a few moments the flora of the northern part of the county of Somerset, in which I lived from 1879 to 1884, with that of the part of the county of Stafford, in which I have been living the last six years. In the early spring we had in Somerset Viola odorata, and its variety alba, and Viola hirta in profusion; here we have only Viola silvatica, which was also a Somerset plant. There we also had in a few habitats Helleborus viridis, which is not to be found here. There we had Silaus pra-

tensis, Geranium pratense, lucidum and columbinum, none of which occur here. Rosa systyla and several varieties of Rosa canina were abundant there which do not occur here, whilst a few varieties of Rosa canina are to be found here which I believe do not grow in that part of the country. And what is the reason? The whole of that part of Somerset is upon the Lias; whilst the whole of my neighbourhood is upon the rocks of the Millstone Grit and Coal Measures.

Again, let us compare the flora of the neighbourhood of Derby with that of Biddulph, and here again we shall see a great difference. In the Cornfields round Derby, Ranunculus arvensis is frequently seen; in the meadows, Alopecurus agrestis and pratensis; in the woods, Milium effusum and Melica uniflora; whilst Hordeum murinum is a common road-side weed. Or if you were to examine the walls in the lanes you would find Draba verna and Saxifraga tridactylites growing in the niches plentifully, and making a pretty show with their white flowers. But what do we find in Biddulph? All these plants are wanting there. Draba verna alone of all these used to grow at Mow Cop, but it is no longer there. In the cornfields we have plenty of Brassica campestris, also a Derbyshire plant; in the meadows, plenty of Phleum pratense, a Derbyshire grass; in the high pastures, Agrostis vulgaris and Festuca, both Derbyshire grasses; and in the lanes an abundance of Stellaria Holostea, also a Derbyshire plant, and one which beautifies the hedge banks with its star-like white flowers. And how is this difference between the floras of these two localities to be accounted for? In two ways: the neighbourhood of Derby has the Alluvium for its subsoil; Biddulph, the Coal Measures: and Derby is only 150 feet above the sea level, whilst Biddulph is at least 590 feet above the sea.

Many give as their reason for abstaining from the study of Botany, the difficulty of remembering the names of the different natural orders of plants, and all the hard words connected with this science, as if every other science and species of knowledge, including history and geography, were not equally full of hard words. But if it be remembered that many of our common or "English" names of flowers are really their scientific ones, as Fuchsia, Laburnum, Camellia, Geranium, Iris, Verbena, Rhododendron, it will be seen that this objection is of no force. And really, practice is the best answer to this objection which is now being considered. When a boy, I was frightened by the long names of the different orders, but when in after years I took up Botany in good earnest, I soon found that all my fears had no real foundation, that they were the creatures

of the imagination, and that in course of time it was easier to remember the scientific name of a plant than its common or English name. Besides this, I would say that the Lancashire Botanists, who are for the most part cotton operatives, and therefore men of limited education in the ordinary acceptation of the term, have no trouble with the names of plants, though these are derived either from the Greek or the Latin Language.

Happy, then, shall I be, if that which I have thus committed to paper is made the instrument of stirring up one or more members of this Society to study God's Book of Nature, especially to consider the flowers of the field. This will bring him into contact with true philosophy—that of knowing the works of Him whose power is great, and whose wisdom is infinite, even of that God who created all things by His Son, the Lord Jesus Christ.

I will now proceed to jot down a few remarks upon the specimens which are to be exhibited this evening.

Ranunculus Flammula, L.—This specimen is exhibited as an instance of abnormal growth, upright and with large flowers. It was growing by itself on the road side, about a mile from Horton Church.

Corydalis claviculata, D.C.—This plant grows in one spot in the Biddulph Valley, and is of frequent occurrence upon the rocks on the east side of Rudyard Reservoir. I have not seen it in the upper part of the Trent Valley, *i.e.* north of Bucknall Railway Station.

Cardamine flexuosa, With.—This plant is of frequent occurrence in all my three districts, Biddulph Valley, Trent Valley, and the Rudyard Basin. It differs from *C. hirsuta* L. of which it used to be considered a variety in being a much larger plant, in having six stamens, long and short, and in having spreading fruit pods. It is usually found in damp situations.

Lychnis Githago, Lam.—This is a corn-field casual with us, and I have not seen it in my district since 1888. Indeed I have only met with it once, on the occasion of my gathering the specimen now exhibited.

Sagina apetala, L.—This plant only occurs on the garden wall at the Station-master's house at Rudyard. I have searched for it in other parts of my district, but in vain. It will be observed

that its upright mode of growth, and the shape of the capsules differentiates it from *Sagine procumbens* and its variety.

Montia fontana, L., var. *rivularis*, Ganel.—This grows only in the stream that leads to Harracles Mill at Rudyard, and was obtained by dredging. The other variety, *minor*, is the true *fontana*, and is of frequent occurrence.

Prunus Padus, L.—Occurs only in the Biddulph Valley, where it is very plentiful. The year that I gathered the specimen exhibited, the hedges near Gillow Heath were full of its blossom, but the flowers did not last long, as an insect attacked them and the leaves, soon stripping the bushes.

Rubus fissus, Lindl. This is a remarkable bramble, perfectly upright. Some of the stems are perfectly barren, whilst others have the flowers and fruit; the barren ones of one year becoming the next year the fruit-bearing panicles. This plant is essentially a moorland plant; it grows on both sides of the Rudyard reservoir, and extends up to Lask Edge, at an elevation of 1000 feet. On the western side of the reservoir it is found in Cliff Wood, growing to a much larger size than on the moors.

Rubus plicatus, W. and N.—This is not such an erect bramble as the last mentioned, though it is one of the sub-erect group. It is easily distinguished by its beautiful white flowers upon thickly hairy peduncles, its thin leaves with cuspidate terminal leaflets. This is one of our commonest brambles, and is found at all elevations between 1000 and 600 feet in all my three districts.

Rubus affinis, W. and N., var. *lentiginosus*, Lees.—This bramble is also one of the sub-erect group, and has pink flowers; thicker leaves than the last, which are also hairy on the under side. It is a much larger and more showy bush than the foregoing. This variety differs from the type in having more slender thorns. It grows only on the railway by the side of Rudyard Reservoir.

Rubus Lindleyanus, Lees.—This bramble is abundant all over my district, and may readily be distinguished by its large open panicle of white flowers, and its naked barren stem, which usually shines as if it had been varnished. The panicle stem is usually of a bright red colour.

Rubus pyramidalis, Kalt.—This is another bramble which is very abundant in the Biddulph Valley and Rudyard Basin,

especially in the latter. Near the ruins of Biddulph Hall it grows to a great size, and may be distinguished from other brambles by its very hairy stems and leaves, large panicles of white flowers, and wrinkled leaves. It fills the cavity of the Bride-stones, 900 feet, and descends to 600 feet. This bramble puzzled our English botanists very much, and I could not obtain a satisfactory opinion upon it until I sent specimens to Dr. Focke, of Bremen, who pronounced it *pyramidalis* of Kaltenberg, and also sent me German specimens of the same, with which my specimens agreed.

Rubus carpinifolius, W. and N.—This is a very large plant, and grows only in one spot, in a plantation near the Rudyard Hotel.

Rubus villicaulis, Koehl.—The specimen to which this name has been given by Dr. Focke, has been identified by him with specimens which the late Rev. A. Bloxam called *R. Salteri*, Bab., var. *calvatus*, Blox. This species is a very handsome one, with very large leaflets on the barren stem. It occurs in all my three districts.

Rubus melanoxylon, Muell & Wirtz.—This plant is regarded as a weak form of *R. Salteri*, Bab. It does not grow with me to any size, probably owing to the exposed nature of its habitat, on the top of a dyke, and to the great elevation at which it grows, close upon 1000 feet on Lask Edge, across which every wind has a clean sweep.

Rubus nemoralis, Müll. *R. Maassii*, Focke, of the Lon. Catalogue. I call it by the first name as Professor Babington does, because Dr. Focke says *R. Maassii* is not found in Great Britain. This is a well-marked species, with prominent veins underneath the leaflets, and with a good supply of small hairs on the barren stem.

Rubus Lindebergii, Müll.—This is my most recent addition to our *Rhubi*. It grows in the Biddulph Valley on a pathway leading from Gillow Heath to Congleton Edge, and is said by the Rev. J. Moyle Rogers to agree with Scandinavian plants in his possession. The small and neat serrations of the leaves are worthy of notice. So far, I believe, this plant has as yet only been found in Yorkshire.

Rubus Sprengelii, Weihe.—This plant is of frequent occurrence with me. It may be easily distinguished by its pink flowers, interlacing peduncles, and hooked prickles.

Rubus Radula, Weihe. This is not a common bramble in my neighbourhood. It may be distinguished by

Rubus corylifolius, Sm., var. *purpureus*.—This grows only in one spot, I believe, in my district; I have searched for it in many places, but in vain. I suspect this is owing to the plant being a hedge-loving one because of its slender stems, thus exposing itself to the danger of being cut down by "hedgers," when they are set to work to trim the hedges of the fields.

Geum rivale, L.—This I have found only in two fields, close together, through which the River Trent runs.

Potentilla Comarum, Nestl.—This plant is not of frequent occurrence in this part of Staffordshire. It grows abundantly at the northern end of Rudyard Reservoir, and in a field between the villages of Newchapel and Brindley Ford.

Rosa canina, L., var. *sphærica*, Gren.—This is the only new rose that I have to report. As its name imports, its fruit is spherical.

Pyrus Malus, L., var. *acerba*, D. C., with glabrous petioles and peduncles, and var. *Mitis*, Wallr., with hairy petioles and peduncles, are of frequent occurrence.

Myriophyllum spicatum, L.—This occurs only in one pool, the Serpentine, near Greenway Bank, the residence of R. Heath, Junr., Esq., in whose private grounds this pool is situate.

Callitriche hamulata, Kuetz.—This plant grows both in the stream leading to Harracle's Mill and the River Churnet before it enters Rudyard Reservoir.

Sambucus nigra, L., var. *laciniata*, L.—This is only a garden variety of the typical plant. The tree from which this specimen has been cut is an old one.

Crepis paludosa, Moench.—This plant I have searched for in vain at the habitat in my district, mentioned by Mr. Garner in his History of Staffordshire, "On the banks of a rivulet, Biddulph," which he gave on the authority of *Shaw*, but in 1890 I had the pleasure of gathering it in Cliff Wood, Rudyard, and again in August of this year on the banks of the Trent, near Lion's Paw Wood. There is but a small quantity in each of these habitats.

Taraxacum officinale, Web. var., *palustre*, D. C.—This variety is of frequent occurrence in my district and is to be found in damp meadows. It is a much smaller plant than the type and may be

readily distinguished from it by the entire leaves, and erect outer-phyllaries.

Lysimachia vulgaris, L.—This plant grows in one spot only in my district. On the eastern shore of Rudyard Reservoir.

Myosotis repens, D. Don.—This Scorpion-grass differs from the true Forget-me-not, *M. palustris*, With, in having a few leaves at the base of its raceme, and by having the teeth of the calix narrow lanceolate-acute. It ascends to 900 feet upon Lask Edge.

Veronica scutellata, L —This I have found only at the north end of Rudyard Reservoir.

Lycopus europæus, L.—This occurs only at Knypersley Reservoir.

Lamium Galeobdolon, Crantz.—This grows only by the side of the rivulet at Biddulph.

Plantago major, L. var., *intermedia*, Gileb.—This plant is of frequent occurrence in all the districts, and differs from the type in being much smaller, and in having its spikes first prostrate, then ascending.

Rumex alpinus, L.—This plant was originally grown by farmers, that their butter might be wrapped in its large leaves for market, and even now it may be frequently met with in old gardens. The plant from which this specimen was obtained was growing near Rudyard in a field.

Betula glutinosa, Fr.—This Birch is of tolerably frequent occurrence in this part of Staffordshire, but I fear that it is not truly wild here.

Salix pentandra, L.—This handsome Willow is found in two of my districts, Trent Valley and Rudyard Basin. In the latter it ascends to nearly 900 feet upon Lask Edge.

Salix undulata, Ehr.—This Willow is grown for the sake of its young shoots, which are largely used for making baskets, &c. Dr. Buchanan White, the principal authority upon willows, says it is a hybrid of *Salix triandria and S. viminatis.*

Salix purpurea, L.—This shrub I have only seen at the north end of Rudyard Reservoir growing on swampy ground. I have

not been fortunate enough to see it in its early stages in the spring and thus to secure its earthing. This pleasure is yet in store for me, when at some future time I hope to obtain specimens so as to settle its varietal name.

Salix viminalis, L.—This Willow is of tolerably frequent occurrence in my neighbourhood.

Salix Smithiana, With. var., *sericans*, Tausch.—This plant has been named thus by Dr. J. Buchanan White. I could not obtain capsules when these leaves were cut, and next spring when I went for the capsules, the tree had been cut down in thinning the plantation.

Populus nigra, L.—This specimen was cut at the same time and place and under the same circumstances as the specimen of *Salix purpurea.*

Empetrum nigrum, L.—A very small quantity of this plant grows upon the side of a road near Rudyard Reservoir, and I look upon it as a remnant of moorland vegetation which should be carefully guarded.

Epipactis latifolium, Auct. — This Orchid grows only in Knypersley Park, and very sparingly.

Sparganium ramosum, L. var. *microcarpum*, Neumann.—This *Sparganium* I have not found with mature or perfect fruit. It grows only in the Rudyard Basin, but plentifully there.

Typha latifolia, L.—This plant, commonly called the Bull-rush, but more properly the Reed-mace, grows in spots only in the Biddulph Valley, and also in the Rudyard Basin, near Rushton Spencer.

Potamogeton rufescens, Schrad.—This Pond-weed is of frequent occurrence in the Trent Valley, where it assumes various forms, since it grows in deep water and in running water, and in the Rudyard Basin in similar habitats. The specimen exhibited was obtained from a pond in the Biddulph Valley.

Potamogeton pusillus, L.—This Pond-weed was dredged for me by the Miss Thompsons of Settle, when on a visit to my house, from the Knypersley Pool. I have since searched its habitats for its flower and fruit, but without success.

Potamogeton pectinatus, L.—This Pond-weed I have only found at Rudyard Reservoir.

Scirpus sylvaticus, L.—This is another Rudyard plant, and is not found elsewhere in this part of the county, though I have seen it in Trentham Park.

Carex paniculata, L., and *C. paludosa*, Good.—These *Carices* grow in the same habitat as the plant just mentioned. Fruit of them cannot be obtained as the ground upon which they grow is mown in the summer, and thus they are cut down.

Carex curta, Good, and *C. rostrata*, Stokes.—Grow upon the small patch of swampy ground where *Potentilla Comarum* also grows, between Newchapel and Brindley Ford.

Carex Goodenowii, J. Gay.—Is of frequent occurrence upon the swampy ground of this part of the county.

Carex pilulifera, L.—I have found only at the north end of Rudyard Reservoir.

Sieglingia decumbens, Bernh.—This grass is found both at Biddulph, and at Horton in the Rudyard Basin.

Glyceria plicata, Fr., var. *pedicilata*, Towns.—This grass grows only at the East end of Rudyard Reservoir, where it was pointed out to me by my friend, Mr. J. W. White, F.L.S., of Bristol.

Festuca elatior, L., var. *pratensis*, Auct.—This is a grass of the cornfields, and will, doubtless, be found to be of general occurrence, though, so far, I have found it only at Knypersley.

Equisetum maximum, Lam.—This plant I found only last July under peculiar circumstances. Mr. R. Heath's gamekeeper told me that he had found a plant in Knypersley Park that he had not before seen, which I could not identify from his description of it, and therefore I asked him to show it to me at its habitat. When I had told him what the plant was, *Eupatorium cannabinum*, I caught sight of the frond of this *Equisetum*, and on further examination of the ground, I discovered that the clump of *Eupatorium* was full of this plant. I was the more pleased to meet with this *Equisetum* since it is not recorded in Mr. Garner's book as growing in the County.

LIST OF NORTH STAFFORDSHIRE FUNGI,

BY

ALEXANDER MACINDOE, M.D., D.P.H.

Order AGARICINI.

Agaricus aurivellus, Batsch.—Aston, September 20th, 1891.
„ æruginosus, Curt.—Willoughbridge, October 25th, 1891.
„ nebularis, Batsch.—Brooklands, October 27th, 1891.
Coprinus micaceus, Fr.—Willoughbridge, April 29th, 1891.
Marasmius fusco-purpureus, Fr.—Maer, October 3rd, 1891.

Order CLAVARIEI.

Clavaria cinerea, Bull.—Willoughbridge, October 15th, 1891.
„ rugosa, Bull.—Birch House Cover, October 31st, 1891.

Order TREMELLINI.

Tremella mesenterica, Retz.—Holloway Lane, October 18th, 1891.
Hirneola auricula-Judæ, B.—Parr's Springs, Nov. 21st, 1891.

Order PUCCINIÆI.

Trichobasis senecionis, B.—Willoughbridge, Sept. 3rd, 1891.
Mellamspora betulina, Desm.—Hill Chorlton, Sept. 29th, 1891.
Lecythea Euphorbiæ, Lev.—Brooklands, October 8th, 1891.

Order ELVELLACEI.

Peziza aurantia, Fr.—Rough Cancro, October 31st, 1891.

SECTION E.—GEOLOGY.

CHAIRMAN.—MR. BARKE.

REPORT 1891-92.

Three Sectional Meetings were held during the past summer, all of which were attended by the President. The numbers of members present were six, eight, and six respectively, besides several non-members.

The first Excursion, April 8th, was to Madeley, by the kind invitation of the Secretary of the Club, who entertained the members to lunch. Two large boulders were noticed in the Vicarage grounds, a granite, 3ft. × 2ft. 9in. × 2ft. rounded, and a trap, 4ft. × 2ft. 6in. × 2ft. 6in., angular, no scratches on either. They had been conveyed to their present position from an adjacent field by Mr. Daltry. In spite of a cold drizzly rain the members repaired to a gravel pit of Boulder Drift at Little Madeley. This deposit probably belongs to the Middle Drift, like the one at Bucknall. There is a bed of fine sand with small fragments of coal, the stratification of which is well marked. There is also a bed containing rounded pebbles and fragments of shells, the latter being too small for identification, and another with boulders in great variety, a fairly large proportion of chalk flints, limestone, Bunter pebbles, quartzites, Hornblende, and other granites, porphyritic and trap rocks. The boulders range up to twelve inches diameter. In the beds containing the rounded pebbles and boulders the stratification is not so distinct.

The second Excursion, May 7th, was made to the Trap Dykes, numerous exposures of which were inspected over a length of six miles, between a quarry near Butterton Church and another quarry near Swinnerton Park. Most valuable and original work is being done by two members of the Section, Messrs. Kirkby and

Collins, in tracing and examining these dykes, for although one or two exposures in road sides had been known to a few individuals for some years, yet they are not shown on the Geological Map of the district, and with the exception of the favoured few, the world passed by and knew not of their existence. I hope our friends will soon have completed their explorations, and present the Club with the result of their very interesting work.

The next Excursion on May 27th was a joint one. The President conveyed an invitation from Mr. Brockbank to the Botanical and Geological sections to visit him at Brockhurst, Didsbury. About eighteen accepted the invitation, amongst whom were several ladies. I record this fact as hitherto none of the lady members of our Club have evinced sufficient interest in Geology as to attend the meetings of the Section. I fear, therefore, the honour must go to the sister Section. Of the "wild garden" with its beautiful collection of plants and flowers it is not for me to speak. It had been intended that the party should go by way of Levenshulme, and, walking along the railway in course of construction between that place and Fallowfield, examine, *in situ*, some beds of Spirobis limestone which crop out in the cuttings. This unfortunately had to be abandoned on account of the weather and the state of the railway, a contingency which Mr. Brockbank had anticipated and provided against by having a large quantity of rock from each of the beds carted to his garden and placed on the walks for inspection. The Levenshume section exhibits the Upper Measures of the Lancashire Coal Field, and is of considerable interest, inasmuch as no less than twelve beds of so-called "fresh-water limestone" are exposed. The limestones are similar, if not identical, to those found at Ardwick, near Manchester, which latter are clearly identical with a bed of limestone which occurs in the Upper Measures of the Pottery Coal Field, and known under the name of "Spirobis limestone." Several of the beds of limestone are rich in organic remains, consisting principally of well-preserved bivalved carapaces of Crustacea of the Order Ostracoda, among which Mr. Ward has recognised species abundant in the Spirorbis limestone of North Staffordshire. The genus Carbonia is represented by the following species C. pungens, C. secans, C. Roederiana, C. fabulina, C. salteriana, C. bairdioides. This group contains limestones of various colours. No. 6 is distinguished as the blue limestone, in others, portions of the same block are pinkish grey in one part, and dark blue grey in the other; the pinkish part being crowded with Spirobis, and the blue full of shells. Among the latter, a species of Anthracomya, similar to that figured by Sir R. Murchison, found at Ardwick. Teeth, ribs, spines, and scales of fishes occur

intermingled with the Crustacea. Mr. Brockbank is of opinion that this group is identical with the Ardwick beds. There was also to be seen in the gardens a magnificent collection of Boulders from the neighbourhood of Manchester. Mrs. Brockbank very generously entertained the visitors, and an extensive series of limestone specimens were examined under the microscope.

On several of the Summer Excursions of the Club, the members evinced much interest in the various geological features that have been brought before them. On the first of these occasions Mr. Daniel, from the summit of Mow Cop, pointed out the hydrographical features of the district, including the water-parting between the Irish Sea and the German Ocean. Numerous impressions of Sigillaria were observed in the grit on the way, and a large deposit of drift sand was visited between Gillow Heath Station and the Biddulph Arms Hotel, where granite boulders and pebbles were seen.

The Manchester Ship Canal has not turned out to be so geologically interesting as might have been expected, and it is not surprising that at the visit of the Club the members were chiefly interested in the structural works of the Canal, both proceeding and completed, rather than in an examination of the material in which the cuttings are made.

The Gypsum mines at Fauld were visited on the last excursion, and proved a great source of interest. Some remarks on this deposit will be found in the report of the excursion.

In a busy district like this, where most of us are fully engaged in the ordinary occupations of life, it connot be expected that very much concerted or sectional work will be done, yet those of us who love to study nature in any of her various phases will find opportunities of doing so, either alone or in company with one or two congenial spirits. And so it is with the members of our section. I cannot pretend to give an account of the unofficial work thus done, much of which may simply go to enrich the observer's mind, but a portion we may hope will result in throwing additional light on some of the problems connected with the past history of our globe.

On Easter Monday a small party visited the curious sand and clay pits on the Weaver Hills. The following is a section of the Couldon Low pit:—1ft. earth, 3ft. 6in. limkstone breccia, dark coloured stiff clay, mottled clay (red and yellow), fine loamy sand

with Bunter pebbles. In the west corner of the pit were some black shales overlying the sand. The upper clay dips north-east; the other deposits are non-stratified. A shaft has been sunk here thirty yards deep in the clay and sand. Two pits were visited at Ribston—the eastern one is a thick bed of white and coloured sand with Bunter pebbles, but very little clay; the western one has thick beds of mottled clay and sand, containing blocks of millstone grit and limestone. The Club also visited these pits under Mr. Wilkins' leadership on 21st May. The opinion formed was that the material composing the clay had been derived from local washings, a view in which Mr. Ward concurs. Professor A. H. Green, in the Geological Magazine for 1867, advocates the view that these materials were derived from the Bunter Beds, and may be of any age later than Bunter times, and adds, "I am far from certain that the Ribston deposits are overlaid by true boulder clay." The discussion is taken up in the following number of the Magazine by Mr. E. Brown, who contends that the deposit is of marine origin, and derived from the Millstone Grit rocks, and is overlain by boulder clay. These beds extend over an area of about two miles in length by one quarter to one and a half miles in width. This is one of the unsolved problems, and I hope the section will, during the coming season, devote its energies to the further elucidation of the subject.

Dr. Hind is at present engaged in studying the Coal Measure Shells with a view of collating our present knowledge of the subject, and bringing it up to date. For this purpose he has collected several hundred specimens, and has visited and been in communication with the curators of the principal museums of the country. I hear the Bibliography of the subject is nearly complete, and when published, will be illustrated by several photographs. Dr. Hind would be very glad of the opportunity of inspecting any specimens in possession of members. I hope that by next winter a part at least of this work will be submitted to the judgment of the geological world.

Two additions have been made to the list of vertebrate remains from the Coal Measures of North Staffordshire this year—one genus and one species. The first-named consists of the upper portion of the cranium of a species of Eurylepis, obtained by Mr. Ward from the shale overlying the Ash Coal, Longton. Previous to this discovery, no remains of Eurylepis have been recorded from the Coal Measures of Great Britain. The genus Eurylepis was first named, and several species figured, by Dr. Newbery (Paleontology of Ohio, vol. ii.), from the Coal Measures of Linton, Ohio. The remains of

a jaw of Acanthodopsis, Hancock and Atthey, has been found in the shale overlying the Woodhead Coal, Cheadle, which evidently represents a new species. Up to the present time very little is known as to the precise nature of the fish to which these jaws belonged. Messrs. Hancock and Atthey have described them as belonging to Acanthodes Wardi. Hitherto no specimen has occurred which affords a clue, and nothing positive can be said in reference to the fishes which bore the jaws named Acanthodopsis.

GYPSUM MINES AT FAULD.

By Mr. F. BARKE.

(Read October 20th, 1891.)

The rocks upon which we now stand belong to the Keuper or Upper Division of the Trias. It will be necessary to give a description of the conditions under which these beds were deposited, in order to understand how the veins and beds of Gypsum which we see so curiously intercalated between the red marls, came here.

During the deposition of the Keuper marls the centre of England was occupied by a great salt lake, such as the Caspian Sea or the salt lake of Utah at the present day, which extended northwards in two great arms or gulfs on each side of the Pennine Chain (the elevation of which had taken place before the advent of the Triassic period), and southwards over Devonshire, Dorsetshire, and the English Channel into Normandy. These marls are about 800ft. thick in Staffordshire, but obtain their maximum development in Cheshire, where they are believed to be over 3000ft. in thickness. This great lake was fed by rivers, but had no outlet to the sea, at least during the deposition of Gypsum and Rock Salt, the incoming water only partially met the loss by evaporation.

Professor A Geikie, from whose text book I have quoted, says, "The study of the precipitations which take place on the floors of modern salt lakes is important in throwing light upon the history of a number of chemically formed rocks. The salts in these waters accumulate until their point of saturation is reached, or until by chemical reactions, they are thrown down. The least soluable are naturally the first to appear, the water becoming progressively more and more saline, till it reaches a condition like that of the mother-liquor of a Salt Works."

Here then we have the conditions under which Gypsum may be deposited. Gypsum begins to be thrown down by sea water when 37% of water has been evaporated, but 93% of water must be drawn off before Chloride of Sodium (Rock Salt), can be deposited. Hence the concentration and evaporation of the water of a salt lake, having a composition like that of the sea, would give rise first to a layer of Gypsum, followed by one of Rock Salt.

This has been found to be the normal order among the various saliferous formations of the earth's crust. But here no Rock Salt has been found, we must conclude therefore that either the water was diluted before the point of saturation for Rock Salt was reached, or the salt, if deposited, has been subsequently dissolved or removed by denudation.

There are other means by which Gypsum may be formed in Nature's laboratory, but it would be unduly lengthening this paper to introduce them here, more especially as I have come to the conclusion that none of them are applicable to the case before us.

Gypsum is a fine granular to compact, sometimes fibrous or sparry rock, can be scratched by a nail, and is unaffected by acids. It is normally white, but may be coloured grey or brown by an admixture of clay or bitumen, or yellow and red, by being stained by iron ixode.

Chemically it consists of Calcium sulphate, with the addition of two-parts of water of crystalization. It is slightly soluable in water, and is a very common impurity in spring water, giving rise to what is termed permanent hardness, as it cannot be removed by boiling.

A band of Gypsum is marked on the Map of the Geological Survey, and extends for a distance of about three miles along this range of hills. Here, at Fauld, it occurs in veins and lenticular masses or pockets, varying from an inch to 35ft. in thickness.

It is only of recent years that the rock has been got by mining, but the industry itself is a very old one. It appears from Sir Oswald Moseley's Natural History of Tutbury, that Gypsum was worked here in open quarries from a very remote period. Referring to the application of this mineral to architectural purposes, he writes: "Perhaps the earliest specimen now extant is in the beautiful Norman arch to the western doorway of Tutbury church, of which the second rim is of native alabaster exhibiting elaborately

carved griffons' beaks." . . . "It is somewhat remarkable," he goes on, "that the comparatively soft material of which this rim is made has been less affected by time and weather than the freestone of the other rims during the 750 years that have elapsed since its erection." He further explains that in this instance, it has been protected by the overhanging rims. It has chiefly been used however for altar pieces and monumental works, many examples of which may be seen in the neighbourhood, as on account of its solubility in water its surface becomes opaque and rough if exposed to the weather. A recent example of its use may be seen in the handsome balustrade at Messrs. Bass's new offices, Burton-on-Trent, the stone from which was obtained from these mines.

The beautiful white semi-transparent variety called Alabaster is much prized for monumental works, and is also in demand for vases, time-pieces, and other ornamental articles.

But the chief commercial use of Gypsum lies in another direction. We see in the workings men drilling holes in the rock by means of steel augers; these holes are charged with powder, and the rock blasted. It is then loaded into trucks and conveyed to the Company's Mills at Tutbury, where it is thrown into a stone-breaking machine and crushed to about the size of road metal; it is then taken up by an elevator and passed through a succession of rollers, until it comes out a fine impalpable powder. It is then placed on a circular pan provided with a pair of arms extending from the centre to the circumference, heat is applied from below to drive off the water of crystalization, the arms are set to revolve so that the whole mass shall be equally heated; little puffs of steam can now be seen arising from the surface, indicating the escape of the water, hence the term "boiling," which is technically applied to this process. When all the water is driven off, the powder is passed out and spread on the floor to cool; it is then filled into bags and is ready to be loaded into trucks and sent to market as Plaster of Paris. This powder, when moistened, takes up two parts of water again and sets to a solid mass. It is used in house building for ceiling cornices, mouldings, etc.; in sculpture for casts, and in the potting industry for moulds.

Gypsum is also used as a manure, though more extensively on the Continent of Europe and in America than in Britain.

SECTION F.—METEOROLOGY.

CHAIRMAN.—MR. NEVINS.

REPORT FOR 1891.—JULY TO DECEMBER.

In presenting the first of a new series of Weather Reports it may be well to offer a few explanatory remarks.

The reports are based on observations noted down each day of the weather experienced at Hanley. These notes refer to the direction and force of the wind, and the nature of the accompanying weather, fine or cloudy, wet or dry, &c. No instruments are used, the measure of accuracy corresponding only to the experience and care of the observer. These observations are supplemented by a daily perusal of the weather reports published by the Meteorological Office, and it is from this source that the information regarding the type of weather is drawn, and also any other notes which may be occasionally inserted regarding the weather in other parts of the country.

For the detailed information regarding the Rainfall at three stations in North Staffordshire which continue to appear in the same very useful form as heretofore, the Society is still indebted to Mr. J. Beaumont Piercy.

SUMMARY FOR JULY, 1891.

The month has been marked by temperature a good deal below the average, with an unduly large proportion of unsettled rainy weather. The temperature has been below the average on 19 days, and rain has fallen on 14 days.

From the 1st to 8th, the weather was cyclonic in type; the wind on the 1st was S.W. and veered to W. and N.W. till the 4th, backing again on the 5th to South, and again veering to W. and N.W. It continued N.W. and Nly. until the 16th. From the 9th to 16th, the type of weather was anti-cyclonic with light winds, and from the 14th to 17th, the weather was warm, with a fair amount of bright sunshine. From the 17th inst. to the end of the month three cyclonic systems passed over the country, the wind shifting from S.W. to N.W., and backing again in the usual sequence. During the last few days of the month the temperature was very low for the time of the year. During the month the force of wind has only once amounted to a strong breeze, viz. on the 6th. From the 1st to the 4th, the weather was showery, with fine intervals; the 4th was a fine day. From the 4th till the 8th the weather continued broken and showery, and on the 8th there was thunder, from the 8th to the 18th the weather was dry, and sometimes fine and summer-like, at other times dull and overcast; similar weather continued till the end of the month, though the 19th, 20th, 29th and 30th were showery.

SUMMARY FOR AUGUST, 1891.

This month has been marked by cold dull weather, and a good deal of rain, with a gale of wind during the final week. The temperature was below the average on 26 days, and above it only on three days. Rain fell on 22 days, the fall being occasionally heavy.

During the first eight days the wind was light from the N.W. and N., with dull cloudy weather, the type being generally cyclonic. On the 9th the wind shifted to the South with warmer weather and rain for a few hours, followed on the 10th by a change to W. and N. with fair cold weather. From 11th to 15th, the wind was from S.W. and W. moderate in force, with occasional sunshine, but generally dull, with some rain; type cyclonic. From 17th to 20th the wind veered from S.E. through South to West, generally moderate in force, with very broken weather, beautiful blue skies for a few hours being followed by overcast showery weather. From 21st to 23rd, wind was North and light with the same variable weather. From the 24th to 26th, it was S.W. to W., on the 25th and 26th, attaining the force of a moderate gale, with sharp squalls, and very heavy rain at times. On the 27th secondary disturbances

were passing over the country, with the wind veering from N.E. to E., S. and S.W. During the last four days a succession of cyclonic disturbances passed, the wind shifting from S.W. to N.W. moderate in force, with fine but showery weather, the month ending with overcast and rainy weather.

SUMMARY FOR SEPTEMBER, 1891.

There has been during the month great variety in the character of the weather, which has been at times dull, cold, and cheerless, and at other times more warm and summer-like than at almost any other period of the summer. The local varietions have also been considerable, as is shown by the difference between the number of days on which rain fell, and the amount of the fall at the three Stations at which observations are recorded in this neighbourhood. Further evidence of this is that at Greenwich, the total rainfall for the month was only 0·78 inches. The mean temperature of the month was a trifle above the average.

From the 1st to the 7th the weather was cyclonic in type, with low temperatures, and dull unsettled weather, the wind being between S.W. and W. From the 8th to the 12th the western side of a large anti-cyclone lay over this country. The winds were light from the S., with beautiful summer weather. On the 13th the wind was S.E., on the 14th N.W., light with changeable weather; part of the day very fine, part cloudy and wet. From the 15th to the 19th the type was again anti-cyclonic, with dull cool weather. From the 20th to the 23rd the wind was successively N.W., N., and E., moderate in force, with overcast wet weather. From this time to the end of the month the wind was S.W. to W., moderate in force, (except on the morning of the 26th when there was a moderate gale), with weather rather unsettled, but fine usually. During this time this country was the borderland between an anti-cyclone lying over western Europe, and cyclonic disturbances rolling up from the Atlantic and skirting the edge of the anti-cyclone.

The in-gathering of the harvest has been much delayed by the cold wet summer, and at the end of this month there was still a good deal of corn standing out in the fields.

SUMMARY FOR OCTOBER, 1891.

This month has been remarkable for disastrous gales, and very heavy rainfall. The rivers in many parts of the country were in flood during all the latter part of the month. In some parts of the country the rainfall has been the largest recorded in a single month.

On the 1st and 2nd inst., secondaries were passing over the county, and then were successive rapid changes of wind usual to such forms, S.W., W., N.W. On the 3rd and 4th the West side of a anti-cyclone was going over the country. On the 5th the first of a succession of cyclonic disturbances of great intensity reached our shores. From then till the 22nd inst., a succession of gales (from the S.W. generally) swept over the country. The maximum intensity was reached on the 13th inst., when the wind in channel was of hurricane force, and the barometer was very low. At Valencia S., the corrected reading was 28·47 inches. In Hanley the force of wind from day to day was less than that recorded in channel and on the West coasts. It blew here with the force of a strong gale on the 13th and 14th, but except on those days it probably did not exceed a "strong breeze" (force 6 Beaufort's scale). On the 21st the barometer was still very low, being below 29 inches at all stations in Great Britain. On the 23rd, the wind got into the North, and the weather became more moderate, and on the 27th, the type of weather became anti-cyclonic into Easterly winds, and so continued to the end of the month. It was fine and dry during this period, and the barometer attained a high level, being above 30·5 inches. The wind moderated and there was frost on the 3 last nights of the month.

SUMMARY FOR NOVEMBER, 1891.

This month has been marked by temperatures somewhat above the average, notwithstanding that on many occasions during the month there has been frost at night. The middle of the month was marked by a heavy gale from the S.W., which attained hurricane force in some places, and was accompanied by heavy rain. The last days of the month were very wintry, snow falling on three days, and the ground being frozen and hard for two days. Rain or snow was noticed on 13 days.

The first eight days of the month the weather was anti-cyclonic in type, the S.E. part of the system lying over this country, and

giving us light winds between N. and E. The barometer was very high for the first two days, 30·7in. in places. During the first four days there was bright summer-like weather, but after that it was dull and overcast. From the 8th to the 13th a succession of cyclonic disturbances passed over the country; the wind was between S.E. and S.W. most of the time, attaining the force of a strong gale here on the 11th. On the 14th, 15th and 16th the wind was E., light in force, with mild dull weather. From the 17th to the 20th the wind was from S.E. to S.W., moderate in force, with muggy wet weather. On the 21st, 22nd, and 23rd, the wind was light and variable from the N., and the nights were frosty. From then till the end of the month the winds were light and variable, between S.W. and S.E., with cold weather, foggy mornings, and occasional falls of snow. From the 14th to the end of the month the type of weather was generally cyclonic, but occasionally "secondary" disturbances crossed the district, as on the 13th, 25th, and 26th.

SUMMARY FOR DECEMBER, 1891.

This month has presented great variations in the weather. During the first and last weeks the temperature was high, on some days being much above the average, while the week before Christmas was marked by sharp frosts, and temperature much below the average. Rain was noted on 16 days, and snow on two days. During the second week of the month the weather was very unsettled and stormy, the wind force at times being a "fresh gale." The last two days of the month were also stormy.

From the 1st to the 16th, the type of weather was generally cyclonic, some "secondaries" occuring on the 10th. The wind "veered and hauled" from S.S.W. to N.N.W. and back again as the successive disturbances passed over the country. On the 10th heavy S.W. gales were general over the whole country, with very heavy squalls, and a very low barometer, the reading being as low as 27·93 inches, in the Hebrides; floods occurred the next day. From the 17th to the 24th, the type of weather was anti-cyclonic, with light S.Ely. winds, fine but misty weather, low temperature, and high barometric pressure. On the 26th, a thaw set in, with falling barometer, and rising temperature. The type of weather was the cyclonic to the end of the month, the wind being from S.W. to N.W.; rainy, unsettled weather set in on the 28th, and continued to the end of the month.

RAINFALL IN 1891.

At three Stations in North Staffordshire. By J. Beaumont Piercy.

NOTE—Diameter of funnel of rain guage is five inches, and height of top above ground is one foot in each case.

WALL GRANGE, NEAR LEEK.

Height of Guage above Sea Level, 457·5 feet.

Month.	Total Depth.	Greatest Fall in 24 hours.		No. of days on which ·01 or more fell.
	Inches.	Depth.	Date.	
January	2·27	·48	31	16
February	·15	·11	3	4
March	1·76	·33	15	18
April	2·11	·52	4	14
May...	3·58	·42	28	19
June	2·49	·55	2	10
July...	2·81	1·18	8	14
August	4·09	·54	8	22
September...	2·79	·67	21	13
October	5·60	·70	5	21
November	2·79	·45	12	13
December	5·00	·80	9	21
Total	35·44			185

THE MEIR. NEAR LONGTON.

Height of Guage above Sea Level, 617·76 feet.

Month.	Total Depth.	Greatest Fall in 24 hours.		No. of days on which ·01 or more fell.
	Inches.	Depth.	Date.	
January	2·26	·57	20	18
February	·12	·3	3	8
March	1·81	·39	7	20
April	2·49	·56	3	16
May...	2·98	·49	21	18
June	4·10	1·64	25	13
July	2·44	·60	8	13
August	5·24	·65	17	24
September...	2·54	·54	21	17
October	5·52	·79	18	21
November	3·27	·75	12	16
December	4·91	·86	9	22
Total	37·68			206

MADELEY, NEAR NEWCASTLE.

Height of Guage above Sea Level, 347·7 feet

Month.	Total Depth.	Greatest Fall in 24 hours.		No. of days on which ·01 or more fell.
	Inches.	Depth.	Date.	
January	2·12	·54	20	13
February	·08	·04	3	3
March	1·57	·34	6	13
April	2·20	·46	4	15
May...	4·10	·46	1	19
June	4·07	1·38	25	12
July	2·66	·49	22	14
August	4·47	·69	9	22
September	4·07	·83	20	15
October	4·39	·73	13	22
November	2·58	·42	11	15
December	3·79	·64	12	17
Total	36·10			180

AVERAGE RAINFALL.

Fall of Rain at Wall Grange is 1·19 in. above the average of preceding nine years.
Fall of Rain at the Meir is 5·48 in. above the average of preceding nine years.
Fall of Rain at Madeley is 7·58 in. above the average of preceding four years.

SECTION G.—ARCHÆOLOGY.

CHAIRMAN.—MR. LYNAM.

REPORT 1891-92.

As you have heard by the Committee's report, the suggestion which was made at the last Annual Meeting, that our Photographic Section might profitably and usefully make a point of procuring and collecting subjects of interest within this County has fallen through, and a new Photographic Society specially established with that object in view has been started, and whilst every member of this Club may well wish the new venture every success, it may, perhaps, be permitted that one who had hoped for the accomplishment of this object among our own members, to express regret that the funds of our Club precluded the taking of the project in hand. It will be remembered that at various times it has been suggested that materials for a complete History of this County might gradually be mustered under the auspices of this Society, and some of us hoped that the Photographic Section would lend much aid in that direction, but without the "sinews of war" very little can be accomplished, and it only remains with us to be content with the decision prudently arrived at by those responsible for the working of our Society.

The report of the General Committee deals with the immediate past work of the Club, and there is no need for repeating any part of it here, but there is a subject which has been suggested to me to deal with on this occasion, I refer to what has appeared in the newspapers as to the tower of the church of St. Giles' at Newcastle. What may be determined to do with it, perhaps no one here is in a position to state, but the local papers have spoken of its being *re-built*. That of course means the complete taking down of the present structure, and therefore the loss of all that remains of the

ancient tower. Surely such a loss would be regretted by every one who has seen the building, or who cares for the preservation of the works of our forefathers. But the real question is, whether or not a re-building is necessary. Now, since the suggestion that allusion might be fittingly made to this subject, I have, with care and pains examined the tower from the base to parapet, and I might give a critical account of its construction and present condition, but that possibly would not assist usefully in bringing what, it is my desire, should be considered this evening. Please to allow it to suffice for me to say, that after investigating the matter thoroughly, I am decidedly of opinion that there is no structural necessity for taking down the present building. Any one accustomed to looking at a building, in respect of its stability, may satisfy himself in a very short time as to the trustworthiness of the opinion just expressed Let any one who wishes to take the trouble to do so, line his eye with the four sides of the tower (as well as can be done for the various projections), and he will find that they are pretty much as straight and perpendicular as the day they were built. Let him then go the top of the parapet and cast his eye down the several sides of the ancient walls and he will find his observations taken from the ground absolutely confirmed. Then be it observed that the walls of this tower are no less than seven feet in thickness, that they are faced with coursed dressed stone both inside and outside, and the construction (with very slight exception in relation to the stair turret) is of truly scientific workmanship. And as far as can be seen the foundations are substantial and sound.

That there are cracks in the walls and that the external facing has to some extent perished, there can be no question, but it is to be observed that some of the cracks reach the ground and that the perished facing is only skin deep when the thickness of the ashlar is taken into account. That repair is necessary there can be no doubt, and the sooner this is undertaken the better for the old building, but to destroy the only remaining early structure left to us in the busy parts of North Staffordshire would indeed be a blow which would be severely felt, and in an early future bitterly lamented.

Here is a print of the ancient Parish Church of Stoke-upon-Trent, taken down about the year 1830. Who does not see the enormous difference in historical interest and prestige such a structure as this would make to the town of Stoke? And will the authorities of the Church of Newcastle denude that ancient Borough and the rest of this district by pulling down the only remaining ancient relic which is left to us? I hope every one here who is satisfied

that the destruction of the tower of Newcastle Church is not necessary will do what in him lies to stay any destroying hand that may be upon it.

It may be asked, cannot the generous gentleman who has come forward to take this matter in hand be trusted to deal rightly with the subject? And can not Mr. Christian, the Architect, be depended upon to show his love for the things of the past? I give an affirmative reply to both these questions, but then we know that popular opinion sways both the generous and the professional man, and if such opinion has been rightly stated by the Press in representing the intention of re-building, we would do our very utmost to gain the re-consideration of those who are to weigh in the balance the continued existence or the early destruction of the magnificent old tower of the Parish Church of St. Giles, of Newcastle-under-Lyme.

THE PALIMPSEST BRASS

OF

SIR ANTHONY FITZHERBERT AND OTHERS

IN THE

CHURCH OF S. MARY THE VIRGIN,

AT

NORBURY, IN DERBYSHIRE.

By A. ARCHIBALD ARMSTRONG, M.A.,

Librarian of Denstone College, and Curator of the School Museum.

(Read, May 23rd, 1891.)

This brass has been treated of at some length by the Rev. J. C. Cox, in his "*Notes on the Churches of Derbyshire,*" Vol. iii, pp. 239 seqq: (1877), and by Mr. W. H. St. John Hope, in a paper read before the Derbyshire Archæological Society, and printed in Vol. iv of their Transactions (1882).

It is, therefore, necessary to make some apology for a further paper on the subject, especially as I am indebted to both of the above gentlemen for so much in what follows. My apology is that, since Mr. St. John Hope wrote, the remaining pieces of this interesting palimpsest have become detached, and thereby a further clue has been afforded to the arrangement of one of the original compositions —in one respect, I believe, unique—while, with the help of my friend Mr. F. Aidan Hibbert, I have been enabled to go a step further than Mr. St. John Hope in the direction of identifying the persons represented in the earlier work. I also give reasons for the conjecture that the neighbouring Abbey of Croxden was their original resting place.

The monument, in its later aspect, used to lie in the gangway of the nave, until it was removed, during the "restoration" in 1841 to its present position in the centre of the chancel floor, between the exceedingly fine alabaster altar-tomb of sir Nicholas Fitzherbert, who died in 1473, and the even more delicately executed one of sir Ralph and his wife, the parents of sir Anthony.

The slab of blue marble, measuring 10ft. 4in. by 4ft. 3in., bore, when originally put down—unless it too be a palimsest and there be on the reverse the matrix of the larger of the earlier compositions, a theory its size would seem to warrant—the figures, slightly turned towards each other, of the famous judge and writer of the reign of Henry VIII and his second wife Maude, daughter of sir Richard Cotton; above, a shield of arms; below, fourteen Elegiac verses; then the children of this second marriage—five sons in a group below the father, five daughters below the mother; round the whole composition a marginal inscription with, as usual, the symbols of the Evangelists at the angles.

Chiselled lines across, with the circles at either end, show that the length of the inscription was altered, and support the idea that the slab was not originally intended for this memorial.

The head of sir Anthony, the group of boys, and all the border fillet, except three small pieces, are lost, while both the principal figures are mutilated at the sides.

The plate on which the judge's body is engraved and both those bearing the Latin verses were missing at the beginning of the century, and have only lately been restored to the Church. They are said to have been found in the old Rectory, the site of which is now occupied by Norbury Hall.

To describe the side now uppermost, taking the plates in the order in which they have been enumerated:—

sir Anthony.—Though the head, as we have said, is lost the matrix, the length of which is 3ft. 1in., shows the outline of a biretta-like skull-cap. The hood appears hanging down the back, the lower border of the cape is visible just above the elbow, and the mantle, the miniver lining of which does not appear, is, as usual, fastened upon the right shoulder; it is worn over a flowing robe, with narrow sleeves, reaching to the feet; the sleeve of an underdress appears at the wrist; of the hands the right alone is visible and holds a scroll.

The person thus represented was the third son of Ralph Fitzherbert, 'of Norbury, in the County of Derby, Esquire,' and was born at Norbury in 1470. He was educated at Oxford, and called to one of the Inns of Court, and in 1511, owing to his "great parts, penetrating judgment and incomparable diligence," was called to the bar as Serjeant-at-Law. In 1517 he received the honour of Knighthood, and during the next six years published several works on law, including his "Grand Abridgement" in 1519, "De Natura Brevium," etc. In 1523 he was made one of the Justices of the Court of Common Pleas. He was held "the Oracle of Law in his time," and his integrity is said to have gained him universal respect.

He came into possession of the Manor of Norbury on the death of his brother John, the 12th lord, in 1531; after which, besides his many legal works, he wrote "Of the Surveying of Lands" (1539), and, perhaps his most important work, "The Book of Husbandry" (1534), many times re-printed during the next few reigns.[1]

Two things are told us with reference to his conduct—(1) That he openly opposed Cardinal Wolsey, when in height of favour, on the score of the alienation of Monastic lands. (2) That on his death-bed, foreseeing the changes likely to happen in the Church, he pressed his children very solemnly neither to accept grants nor to make purchases of Abbey lands, and this, it is said, they promised, and kept to, much to their own loss.

He died 27 May, 1538, and was buried in his own parish church of Norbury, there being placed over him "some time afterwards,"[2] this "blue marble stone" with its brasses.

His *second wife Maude*, now a widow, is represented with the later species of wimple, peculiar to widows, about her throat. Her pedimental Tudor head-dress is also covered by a widow's veil, which falls down upon her shoulders. The square-cut gown of the period,[3] is partly concealed by an heraldic mantle bearing the arms of Fitzherbert on the dexter side, and on the sinister a portion of the quarterings of Cotton of Ridware, showing the arms of Falconer. This mantle is fastened on the shoulders by cords passing through two metal ornaments or *fermailes*. The edge of

1 Biographia Britannica, Vol. iii. 1938.

2 Biogra. Brit: iii, 1939.

3 Compare numerous portraits in Holbein's "*Court of Henry VIII.*"

her gown is slightly furred in front and she has deep fur cuffs. The girdle has a rosette for clasp, and from it hang two long chains terminating in tassels. Her shoes, as well as those of her husband, are round-toed.

The *Shield* above bears the two Fitzherbert coats quartered, impaling the Cotton quarterings :—

FITZHERBERT :—

1st and 4th *Gules, three lions rampant, or* (old coat).

2nd and 3rd *Argent, a chief vairé, or and gules, over all a bendlet, sable* (later coat).

COTTON :—

1st *Azure, an eagle displayed, argent* (Ridware).

2nd *Gules, three swords erect argent* (Waldeshef or Wadshelf).

3rd *Argent, three falcons, gules* (Falconer).

4th *Azure, two bars, argent* (Venables).

Over all, on an escutcheon of pretence—*argent, a bend sable, between three pellets*, for Cotton.

The next two plates[4] 22¼ inches long, by 9¼ and 7½ inches wide, respectively, contain a *Latin Epitaph*, said to be of the Judge's own composition. The verses, with the many contracted syllables filled in, run as follows :—

Ille ego qui quondam fuerat dum vita Superstes.
Viventes inter clarus honore fui
Marmoreo hoc claudor specu hac sub mole quiesco.
Hec domus hic nitor est hoc theatrale decus.
Atria gemmatis non hic sunt aurea basis.
Non que sit tyria palla retincta manu.
Gemma procul nihil est nostro nisi pulvis in Antro.
Palla procul, Corpus nil nisi vermis habet.
Hec habeo solum que Vivus in orbe Peregi
Et que sunt Vivo corpore gesta Meo

4 It will be seen by comparing the positions of the rivet-holes with the remains of the rivets in the matrix that the plates were not originally in the order in which Dr. Cox and Mr. St. John Hope (relying on Dr. Cox' usual accuracy, I suppose,) have placed them.

Prefuerum iudex cogor nunc iudicis ipse.
Alterius iustam Sustinuisse manum.
Sed Precibus tu Sancte tuis tu Æterne salutem.
Confer et Offensas dilue Christe Meas.

I quote a rendering given in Dr. Cox' notes :—

I, who 'mongst men, while life remained to me,
To honour rose by only honouring Thee,
Imprisoned sleep within this marble tomb ;
This all my courtly pomp, and this my home—
Here shine no gilded halls in jewelled pride,
Nor purple robes by Tyrian craftsmen dyed ;
No gems but dust alone my cavern holds,
No mantle but the worm my corpse enfolds.
A lifetime's deeds are all that here I have,
Who by my works am followed to the grave ;
Though erst a judge, now at the bar I stand,
And wait the judgment of a juster hand.
But, holy Christ, hear—for Thyself dost pray—
My pardon grant, and wash my sins away.

Below the figure of sir Anthony is the matrix of *the group of sons*, who were five in number :—

(1) sir Thomas Fitzherbert who married the heiress of Eyre of Padley and died without issue, after suffering much persecution as a Roman Catholic.

(2) John, who married Katharine Restwold, and whose eldest son, a thoroughly unprincipled character, was, on the death of his uncle sir Thomas, given the Norbury estate, as being the only Protestant in the family.[5]

(3) Richard, who married Mary Westcott.

(4) William, who married Elizabeth daughter and co-heiress of Humphrey Swynnerton, and brought the Swynnerton estates into the hands of the Fitzherberts of Norbury.

(5) The eldest son who died in infancy and whose name does not appear to be known.[6]

5 A nephew of his was the last of the Fitzherberts who resided at Norbury. He died in 1649, and then the property passed into the hands of the Swynnerton branch. (4)

6 The daughters seem to be placed in the order in which they were born. The first, though she died young, heads the group ; the same order was observed in the case of the sons, who, of course, faced their sisters.

Below the figure of their Mother is *the group of five daughters*, their names being given on the lower plate :—" dorothe and dame dorothe Elizabethe Alys and Katheryn."

(1) and (4) The first Dorothy and Alice who died unmarried. They are represented smaller than the other daughters, and over the head of the former is a scroll bearing the words Misericordias domini (in a much contracted form) and a small hand with finger pointing in the direction of the continuation over the latter in eternum cantabo.

(2) The second Dorothy, who wears an heraldic mantle, showing she must have been married to her first husband, sir Ralph Longford, before the brass was put down. The coats represented are Longford—*Paly of six, or and gules, over all, a bend, argent*, and the Fitzherbert coats, as before, quarterly. Her second husband was sir John Port.

(3) Elizabeth, who became the wife of William Basset, of Blore and Langley of whom we shall have to speak in connection with Croxden.

(5) Katharine, who became the wife of John Sacheverell.

The last two on the above list have each an outer gown with loose sleeves, cut square and low at the neck, thereby displaying an underdress (cf. again Holbein's portraits) of which the sleeves are striped longitudinally and frilled at the wrists. (2), (3), and (5) wear what is known as the "Paris head," a style which came into fashion after the pedimental one, worn, with flowing hair, by (1) and (4).

The *marginal inscription*, on a fillet 2 inches wide, ran :—

Of your charitie praye for the soul of sir Anthony Fitzherbert, Knyght, one of the King's Justices of his Comen benche · and sometyme lord and patrone of this Towne · and Dorothe his wyfe · daughter of sir Henry Willoughby Knight · and dame Maude his last wyfe one of the daughters and heirs of Richard Coton of Hampstall Rydware esquier by whom he had five sonnes and five daughters · which sir Antony deceased 27 May A° Dni 1538 · and the said Dame Maude . . . . [7]

7 Le Neve, Harl: MSS: 3609, quoted by Dr. Cox.

The date of the survivor's death would seem, as is so often the case, not to have been afterwards filled in.

Of the above legend only the three pieces underlined remain. On the last of them occurs a helmet, the sole survivor of the ornaments which were occasionally placed at intervals on border fillets.

The circular plates in the corners are all lost, but a good idea of them can be formed from the brass of John Lymsey, 1545, Hackney, Middlesex.

We now come to the details of the reverse, in which we have to assign the various plates, as far as possible, to their places in the original compositions.

Of the eleven plates now remaining, ten are engraved on both sides—the eleventh (lower part of the daughters group) was new in 1538, and is a good example of the poorness of the plates then in use—and may be grouped as parts of two earlier memorials. The plates bearing the Latin verses go far towards the completion of the one, while the remaining eight show the size and arrangement of the other.

This latter consisted of the figure of a lady (about 5ft. 3in. high) under a canopy, flanked by small figures in niches, six on each side of the principal figure. The reverse of *sir Anthony* shows flowing drapery and a pointed shoe resting on the back of a lion, as at Westley Waterless, not, as is more usual in the case of a lady, on a lap dog. The reverse of *Dame Maude* shows what is undoubtedly the upper portion of the same figure, as far as the lower part of the nose.

The lady thus discovered will take her place with the ladies of Trotton (1310), Cobham, Kent (1320), Westley Waterless (1325), and Minster (1330), and wears the dress of that period—a wimple, or gorget, round the face, chin, and throat: a kerchief over the head, falling gracefully to either shoulder: below, a kirtle, of which only the tight sleeves appear, strange to say, without the innumerable buttons of almost all other brasses of the time. Over the kirtle a loose tunic with wide sleeves, and, apparently, no girdle[8] as the folds run from top to bottom. Lastly comes the mantle gathered up in a knot under the right arm.

8 Cf. Margaret de Camoys, Trotton, 1310, and Joan de Cobham, *circa* 1320.

The *shield* plate is valuable as giving the key to the upper part of the composition. It shows the top of the arch under which the figure stood, and, above, the straight sides of a pediment with a few lines belonging to the crocketing on the outer edge. This, no doubt, and the finial at the top, would resemble those of the little canopy shewn on the reverse of Dame Maude's head. In the tympanum is a quatrefoil surrounding a small figure, seated, with arms extended as if in welcome.[9] This attitude I imagine to be unique. The Figure found in this central position in the upper part of the Flemish brasses generally holds, in a sheet, a small naked figure representing the soul of the departed, and, according to Haines, is intended either for the First Person of the Trinity or for Abraham. The background of this, as of the next piece, is diapered with trellis work.

The *upper part of the group of daughters* bears a monk with hands crossed and pointed downwards (cf Abbot de la Mere, S. Albans, &c.) under a small canopy: on the left are the letters LLE : GI in Lombardic type — part of a marginal inscription. This position of the letters shows that it belonged to the left hand side, and it is further proved to have been the lowest niche on that side by the stilted base at either side, and, on the right hand side, by that of one of the shafts supporting the large canopy.

The *head of Dame Maude* shews the top of a corresponding niche, terminating in a line of battlements, on the other side and the feet of an upper figure. The lettering, to the extent of half a V and N, is visible on the right hand side.

This canopy, which is cinquefoliated, affords, as we have said, the clue to the large central one, and suggests a line of battlements along the top of the entire composition as at Balsham, Cambs.[10]

The *three remaining plates*, fragments of the marginal inscription, bear the following letters: — ME : MON : SIRE, — OBAVD : DE : V — V : PAR : SA : Lines to the left of the first show it to have come on the bottom at the right hand side. Measurement shewing that this inscription must have contained about 100 letters, it has been restored, thus :— ✠ MATILDA DAME MON SIRE THEOBAVD DE VERDVN SEIGNEVR DE CESTE VILLE GIST ICI DIEV PAR SA ALME EYT MERCI · AMEN.

[9] For disposition of the drapery compare the small figure of S. Ethelbert from the Cantilupe shrine in Hereford Cathedral.

[10] Or, better still, several brasses engraved in Dugdale's *History of S. Paul's.*

That this figure and its elaborate surroundings formed one unbroken surface of closely-fitting quadrangular plates, like the Flemish brasses, and were not set in separate matrices is shown by a small piece of background close to the right elbow, also by a narrow strip on the right hand side of the plate containing the monk. It is to be observed, moreover, from these, that the space between the large figure and the canopy is plain and not diapered as the flanking niches and tympanum are.

Turning over, finally, the two plates engraved with the *Latin Epitaph*, the upper is found to represent the greater part of a man in monastic attire, though curtailed in every direction: the folded hands are visible, and the long sleeves of the habit, while the cowl falls almost down to the elbows, as in the brass of Prior Nelond at Cowfold, Sussex (1433), which it closely resembles in style of engraving.

The lower plate bears parts of ten hexameters in two columns, as follows:—

[? En Tho]mas quondam prior · hic tellure quiescit :
. . . . s hunc versum memor · esto que morieris :
. . . . sana fer quid · vult signare cadaver :
. . . . flores cito · marcent hen que dolores :
. . . . ista leges · mi frater funde precamen :
Inquieti mundum sibi pax . . . . . .
Vile cadaver sum · fal . . . . . .
En caro da que data · be . . . . . .
Qui dant merores cum . . . . . .
In penis degeres ut ab : . . . . . .

The original length of this plate would appear to have been 35 inches, 3½ inches having been cut off the earlier part of the first column and 9 inches from the end of the second.

The date of the inscription appears to correspond to that of the figure last described (c. 1440) and there is little doubt that these two plates again formed parts of one composition—a Prior with Verses below, and, probably, a light canopy above and a border fillet stating his name, date of death, etc.

In conclusion.—As to the identity of those to whom these last two memorials were originally laid down, and the reasons for thinking them to have been brought from Croxden.

(1) The *lady*, when compared with the examples quoted above, would seem to date from c. 1310-1320, while I am informed by one who has made a special study of Norman-French inscriptions (Rev. J. E. Field, of Benson) that the Lombardic characters will not allow of it being placed later than 1330.

The name Theobald de Verdun plainly occurs, and this, with the dates given above, would point to these being the remnants of a memorial to Matilda the wife of the Theobald, lord of Alton, who died in 1316. She died in 1312, and was buried in the south transept of Croxden Abbey.[11]

(2) Neither the British Museum nor the Bodleian Library, in both of which I have caused search to be made, can discover any list of Priors of Croxden during the XV century. My chief reason therefore for thinking *Thomas quondam prior* to have been of that Foundation is the one which I would give to establish my last point.

The Dissolution of Croxden Abbey took place in October, 1538, and the greater part of the plunder forthwith became the property of William Bassett, who, it has been stated, married sir Anthony's daughter Elizabeth, and, though, as we have said, the judge's *children* promised to have nothing to do with the spoils of the monasteries, his son-in-law was, apparently, not so scrupulous, and, after buying monastic belongings, would hardly hesitate to make some of them thus serve his turn and save his purse.

I understood that measures were being taken, some time ago, for the securing of this most interesting monument against further loss. Nothing has yet been done; and, as there is the chance that, if any steps are taken, they may be in the wrong direction, as at Magdalene College, Oxford, and Walton-on-Thames, where it is difficult, if not impossible, to obtain rubbings of the palimpsest plates owing to the way in which they are secured, I would mention the plan suggested to me by that veteran brass rubber Mr. W. H. James Weale of the South Kensington Museum. It is, that the various plates be fixed as panels in a strong frame-work. This, like the frame-work of a door, to be on hinges, and let in so as to be flush with the wall of the Church when shut, displaying the later brass: when open it would allow of equal facility for seeing and taking impressions of, the very valuable example of earlier work so long hidden from view.

11 If this be the date of our brass it will take the place of that of Joan de Cobham, Cobham, Kent, as affording the earliest known instance of a canopy on this kind of memorial.

A FEW JOTTINGS ON SOME STAFFORDSHIRE CAMPS.

By CHARLES LYNAM, F.R.I.B.A.

(Read February 18th, 1892.)

There is no doubt much general advantage in the fact, that the diversities of archæological interest, have their respective attractions for different minds; but it is not perhaps unsafe to say that the *earliest* work of the hands of man have, with most antiquarians, a surpassing and absorbing influence. Who, for instance, is forgetful of his first sight of that weird assemblage of strange monoliths at Stonehenge? Who does not still feel the amazing wonder which struck him when he first looked from rising ground on those great masses of unhewn rock which imperfectly mark the boundaries of those mysterious works at Avebury? Again, the impressions produced by those rings of rocky stones on far hill tops, known as Druidical circles, have with many of us their abiding memories. So also of the Cromlech and the Menhir on the wild moors. And there lingers with us the gentle slopes of those strange conical hills, such as Silbury and Arbor Lowe. Still, too, the square Roman Camp, with its vallum and fosse of formal type, tarry in our minds. And further yet, other remote works of which we have, perhaps, thought but little, still impress the memory: amongst them, not least, the early camps; of a few of which still remaining in our own county, we now propose to take some particular note

A glance at the map of Staffordshire will shew the position of the places referred to. They are: 1, Maer, called "Berth Hill;" 2, Darlaston, known as "Bury Bank;" 3, Billington, near to Stafford, marked on the Ordnance Map as "Berry Ring;" 4, "Castle Ring," on Beaudesert Park, near Rugeley, and 5, Kinver Edge, near Dudley, and to these is added another at Chesterton, near to Newcastle-under-Lyme.

The distance between Chesterton in the north-west and Kinver Edge in the south-west is about 40 miles in a direct line. Besides the works here noticed, there are others of considerable extent within these limits, not now to be brought forward. Thus, however, it will be seen how completely this part of the Mercian kingdom was studded with works of fortification.

The County of Stafford cannot boast of possessing a single Stone circle, but that at Arbor Lowe is not far from its boundary, and throughout the county there are Lowes of varied sizes, and in earthworks, such as those we are now to consider, we may be said to be rich. Perhaps the only relic of pre-historic times is the ancient burying place known by the name of the "Bride Stones," on Biddulph Moor.

Of course the "everlasting hills" and their accompanying valleys bore the feet of the earliest inhabitants, and are with us still, and it may be the brooks and rivers ran along their present sinuous ways far before any Briton first partook of their waters. Sometimes one thinks, how little we consider the immense utility of these streams. Look, for instance, at the course of the River Trent on the map. How it rises up in the north, proceeds in a southerly direction, and then turns east, and crosses a long length of the county and leaves it on its eastern boundary, then how so many of the other rivers and brooks deliver their waters to this one stream. The Dove, the Manifold, the Churnet, the Sow, the Penk, the Blyth, the Tame, and many others all join the Trent, and it will be seen that this one water-way carries off the rainfall from a very large part of the whole of the county, relieving it of its flood waters and leaving the broad valleys sound and dry. Surely this is usefulness which should not be forgotten.

The only other works of man now existing which were coeval with the earthworks under notice, are the two Roman ways known as "Watling Street" and "Icknield Street." The directions of these streets are also marked upon the map from which it will be seen that the Watling Street entered the county from Uriconium in the west at Stoneyford, or Newpool and left it in the south-east at Fazeley Bridge. That the Icknield Street started at Watford Gap, near to Shenstone, and crossed the Watling Street near to Wall—that is ETOCETUM in the vicinity of the City of Lichfield —and left the county near to Burton-on-Trent.

That these earthworks were for the purposes of succour and defence there can be no question. That they form a series along

a continuous course is tolerably clear. They bear internal evidence that they were constructed by the same people, for their main characteristics are strikingly similar.

In every case their situation is on high ground from which full command is obtained, both of their immediate surroundings and of very extensive distant prospects. In fact, from each of them, a clear panoramic view of vast extent is procured of the surrounding country. In each, one or more sides are immediately bounded by the steep slopes of natural hills. Their shape is of irregular form; those sides next the slopes follow the line of their upper edges and the other sides are more or less circular in form, as distinguished from the rectangular.

The mode of construction seems to have been as follows:—The site having been carefully selected with command and defence in view, and the size determined upon, the ground within the prescribed area was used for procuring the necessary materials for the walls by excavation. This material, with that from the ditches, was thrown up into single banks along the lines of the adjacent steep slopes about 6 feet in height. On the other sides from one to three banks were thrown up with corresponding ditches of varying widths and depths. The magnitude of these walls and entrenchments was determined by the nature of the adjoining lands. Where they were flat and easily approachable, there the works of defence were the strongest, but where natural obstacles to approach existed by slopes or otherwise, the works of defence were reduced to a minimum. But what these forts always afforded was an internal area of from about 3 to about 10 acres in extent, enclosed within a well-raised bank, on the outside of which were either the steep natural slopes of the hills or raised banks and sunk ditches giving to those within the enclosure, a safe security from surprise and a very formidable defence against an invading foe. The tops of the banks had the further defence of a stockade, sloping outwards from its base, making a formidable barrier in addition to the banks and ditches.

In illustration of the form and construction of these works, plans, and sections, are here shewn of several of them. As the history of the Camp at "Bury Bank," near to Stone, has been more amply recorded by early writers than any of the others, it will be as well that it should be *first* referred to. Of this are shewn, a plan, two sections, a small photograph (taken by my son) and a water colour sketch (made by Mrs. Lynam). In plan it is an irregular ellipse about 140 yards in length and 100 yards in width and contains an area of about 3½ acres. Within this area, near the south end, is a

raised mound rising about 7 feet above the surrounding surface. Encircling the area is a wall or vallum varying from 30 to 40 feet in width and from 3 to 4 feet in height. Outside this is a flat space which forms the top line of the great fosse, which is also bounded by another wall, and this runs along the line of the slope of the hill. The entrance to the enclosure is at the north-west, and is by a narrow roadway between two raised flanking mounds, and is, in fact, the prototype of the later Castle entrances.

Dr. Plot in his Natural History of Staffordshire, published in 1686, thus quaintly describes this place. "On the top of a hill there yet remains the ruins of a large *castle*, fortified with a double vallum and entrenchments, about 250 yards diameter, the gate seeming to have been on the west part of it where the side banks on each hand plainly appear: others fancy there was a second gate on the east side too; though I could not perceive any probability for it, but on the south side there is a round conical hill, much like a tumulus cast up higher than all the rest of the work, which, according to the tradition of the country thereabout, was the seat of Ulferus, King of Mercia, who murdered his two sons for embracing christianity. Mr. Sampson Erdeswick asserts that he had seen an old writing relating to the foundation of the Priory of Stone that affiirms as much: which may, perhaps, be that of R. de Suggenhill and Petronel his wife, whereby they gave to the Church of S. Mary and S. Ulfade of Stone. Messuagium juxta montem qui dicitiur Ulferecester in terroris de Derlaston; which index proves fully that this was the royal *mansion* of the said Ulferus who governed Mercia from the year of Christ 657 to 676, the Lowe (tumulus) adjoining being in all probability the place of his sepulture."

Accepting this interpretation of the Charter of this Priory we see how valuable such Charters may be historically. Another instance of the kind appears in the Charter of the Abbey of Hutton, where Lord Audley, of Heighly Castle, gives to this Abbey, the Grange of Normacot; one of the boundaries of which is therein described as being adjacent to "Rykineld Street." Of this street not a vestige is now known to remain, nor does tradition give it a name. But Mr. Ward in his very careful History of the Borough of Stoke-upon-Trent, dwells on the fact of this description in the Charter and connects this street with the Camp at Chesterton (of which more will be said presently) and founded the theory that this Chesterton was in reality the missing Mediolanum of the Romans.

A plan is also given of "Berth Hill," from which it will be seen

that the leading features are very much in correspondence with those at "Bury Bank." The shape is more irregular in form, but this is the result of following the contour of the top of the hill, and it will also be noticed that at the south-west angle of this camp there is a sharp projecting promontory, and no one can mount its top and not perceive that it partakes of the nature of an outpost, and it is not improbable the mound at Bury Bank was for the same purpose and formed, as it were, the *keep* of the Castle, and not, as I venture to think, the burying place of the King. It was, I believe, the prototype of the mound which afterwards became common as the foundation of the Castle Keep.

The question of the supply of water to the camps is not to be un-noticed, and in each case its source is tolerably apparent. Bury Bank rises from the side of the River Trent, Berth Hill from the River Tern, which takes its rise just below the camp, and at Bury Walls, in an adjacent county, there is to this day the well which apparently supplied the inhabitants of the fort. The enclosure at Berth Hill has a length of 330 yards, and of 178 yards in width, containing about 9 acres. A water colour sketch of a bit of the north-west side of this camp—also by Mrs. Lynam—is here shewn.

The inner banks at Berth Hill and Bury Bank are all formed of a mixture of earth and rubble stone, but there is nothing in the nature of building stone now to be seen at these places, unless it be the fact that any such building stones have been removed from time to time, it would seem that the "*Mansion*," of which Dr. Plot speaks at Bury Bank, must have been built of nothing more substantial than timber, unless indeed he regarded the whole premises as forming a "*Mansion*."

"Bury Walls" has been incidentally mentioned, and I have a plan of it, but as it is out of this county and has been ably dealt with by Mr. Daltry, I leave it for the present.

Of Billington, near to Stafford, a plan is also shewn. In general arrangement, it follows those already mentioned, but its banks and ditches are on a larger scale than the others. Its approach is from the table land of the hill at the east end and it is very strongly guarded by flanking mounds. The foot of the hill, on which it is placed, reaches a tributary of the River Sow, which flows through Stafford to the Trent. The internal area of this camp measures about 250 yards long by 158 yards wide and contains about 7 acres. In shape it is more rectangular than the others, the site itself being less irregular in section.

Castle Ring, on the borders of Beaudesert Park, is shewn by a plan; it differs from the others by being open and free from wood, and in that it is encompassed by more table land than is usual, though it adjoins the slope of a steep hill on the north side. Its walls and ditches are very perfect and in section of great size. It appears to have had two entrances, one to the north-east and the other to the south-west. At present a roadway runs through the camp between these two gates.

In the midst of this camp the foundations of a substantial building of stone still remain, measuring 65 feet by 37 feet; their date is late in the 14th century, and they were un-earthed by our member, the late Mr. Molyneux. This building, perhaps, gave rise to the name of "Castle Ring." In the midst stood the castle and round it the rings of alternate trench and bank. The dimensions of the enclosure are 267 yards in length and 183 yards in width, and the area 8½ acres.

The example on Kniver Edge is much more regular in form than those already noticed, and is in fact rectangular except that at its north-east angle it runs into the steep slope of the adjoining hill. On the western and northern sides, it has slightly raised mounds, which bound the upper edges of the adjacent steep slopes. On the southern and eastern sides there are high mounds and deep entrenchments, and the gate appears to have been at the north-east angle It measures about 307 yards in length and 170 yards in width, and has an area of about 7½ acres. The views from its summit are again most extensive, and embrace the Malvern Hills, where it is well known that great earthworks are still extant.

There now only remains to be noticed the extraordinary Camp at Chesterton. At the present time its most remarkable feature is the great fosse on its northern side—of which Mrs. Lynam exhibits another sketch. But it will be seen from the plan that the form of the camp is strictly rectangular, and the present occupation roads, which run through it, seem to indicate the positions of its original lines of division, and its name, of course, is essentially Roman. To the eastward, building operations have interfered with that part of the site, and now the undisturbed area measures only 180 yards in width by 223 yards in length, with contents of about 5 acres. The whole of the site is broken and irregular on the surface and its herbage is peculiar in character. It stands high in respect of the surrounding country and the prospects from it are very commanding and extensive in every direction.

Mr. Ward, as I have said, claims that this Chesterton is no other than the City Mediolanum, and that there passed through it roadways to Deva and Uriconium, and he points to the existing RED STREET as leading to Chester and the Ryknield Street, defined by the Charter of the Monks of Hulton as leading to ROCESTER and Burton-on-Trent and to the Roman Camp at Cheswardine, as on the way to Uriconium.

Dr. Plott says that in his day there were remains of great walls on this site, but nothing of the kind now exists, and though some search has been made in recent years, nothing beyond the head of an early tobacco pipe has been found. But Chesterton was for many years a seat of the manufacture of the old "Churchwarden Clay." That study and research would well be repaid here, there can be little doubt, but by whom this is to be made must, I fear, remain an open question.

These few notes touch only the threshold of the subject of the ancient camps in this county, and my hope is that at some future day I may be able to bring further results of observation and study before this society. One reflection forces itself upon me at the close of this Paper, which is, that whilst Wulphere, the Mercian King, had to trench and bank and mound himself in his "mansion" at Darlaston at this time, "*every* Englishman's peaceful home is his unassailable *Castle*."

SECTION H.—PHOTOGRAPHY.

CHAIRMAN.—MR. WHYTEHEAD.

REPORT 1891-92.

The Photographic Section has not shown as much vitality during the last season as formerly, perhaps the dull summer discouraged it. Those members who make it a relaxation, and not a business, found very few days to tempt them out, and I believe the Camera Section had not a single representative at several excursions. The birth of a new society called together for the purpose of making a photograhic survey of the county threatened the existence of the section, so in self-defence a meeting was called of the Council, as it was at first thought that the work might well be undertaken by our Club; after deliberation it was decided that as the projected scope of the new society exceeded the bounds covered by the Field Club, matters should be allowed to go on as before, so to revive the section, a notice was sent out to all members of the Club, requesting those who had not done so before, and willing to co-operate with cameras, to send in their names; I regret that it has met with no response so far, although there is yet time before the excursions commence. I only know of twenty members who practise photography, but there must be far more. It is thought that at least one camera should accompany each excursion, and provided enough declare themselves willing to work, this should be an easy matter.

The pictures exhibited to-night are entirely the work of our members, but are not confined to the county, and most of them were taken independently of Club excursions. It is to be hoped that the older society will not suffer in support through the more tempting advantage offered by the Survey Society, but I am conscious that we shall always work at a disadvantage so long as we have no fixed home of our own, where the work of our members could receive the attention and care that it deserves.

The vote of £5 towards defraying expenses of Photographing Geological Sections comes as a surprise, and I am not prepared to say what can be done with it, but the limit being known, there is no reason why it should be exceeded.

JOURNAL OF PROCEEDINGS.

EXCURSIONS.

I.—HEAD WATERS OF THE TRENT.

MONDAY, April 20th.

LEADER—Mr. A. T. DANIEL.

About thirty members of the Club joined the First Excursion of the season, taking train to Congleton. The party then drove to the foot of Congleton Edge. This hill was ascended, and the walk was continued along the Edge to the summit of Mow Cop in a rather cold wind. There was an excellent view of Shutlings Low, the Roaches, and other hills lying to the east, but the prospect across the Cheshire plain to the Welsh hills was obscured by mist. On the way, some old coal workings and geological sections were shown.

On reaching the top of Mow Cop, the Leader made a few remarks about the Trent watershed, which is visible for a considerable distance in both directions from this point. He pointed out that this was a portion of the chief east-and-west watershed of England, the streams of the one side flowing by the Trent into the German Ocean, and those on the other flowing by the Mersey into the Irish Sea. In a north-easterly direction the line of watershed is seen crossing the Biddulph Valley, being in its lowest part about 650ft. above sea level, then rising rapidly to a height of 1100ft. on Biddulph Moor. From this point, it follows the line of hill to Bridestones, and then falls rapidly to a point slightly north of Rudyard Lake, where it is very little above 500ft. The natural line of demarcation of the two basins is here so slightly marked, that Dane water is taken by the canal feeder across the water-parting to Rudyard Lake, and so into the Trent basin. From this point it maintains an unbroken elevation of 1000ft. or more along the Pennine Range as far north as the Ribble gap. These two noticeable depressions—in the Biddulph Valley and above Rudyard Lake—in the line of watershed, are accounted for by the synclinal troughs which it crosses at these two points. At first sight one would expect the water-parting to be identical with the line of hill extending from Mow Cop to the Cloud forming the county boundary, but this is cut through by the Dane-en-Shaw brook in the line of a fault.

Turning to the south-east, only a very small wedge of Mow Cop belongs to the Trent basin, as the watershed passes down by Golden Hill and Bath Pool towards Keele. The Leader made some further remarks on the character of the watershed.

There are two claimants for the honour of the source of the Trent, the one rising on Mow Cop and the other on Biddulph Moor. The Leader for a variety of reasons preferred the claim of the former; and some interest was imparted to the proceedings by a letter from Mr. Brough warmly supporting the right of the latter. As the Biddulph Moor stream which passes through Knypersley reservoir rests its claim on the Ordnance Survey, (which the Leader had unfortunately not seen on the 6in. scale), it should certainly be regarded as the source of the Trent.

The party then pushed on to Gillow Heath, where at the Biddulph Arms they addressed themselves, with appetites sharpened by an eight miles' walk, to the discussion of a substantial tea. This disposed of, the Rev. T. W. DALTRY moved a cordial vote of thanks to Mr. DANIEL, and congratulated him on the complete success of the first Excursion which he had conducted. All present, he was sure, desired that it should by no means be his last. Mr. ARTHUR E. NEVINS seconded the motion, which was carried with acclamation. After acknowledging the compliment, Mr. DANIEL said he had observed traces of the "open field system" between the top of Mow Cop and Gillow Heath, and he would be glad of any information of the existence of this custom in the north of the county. It was then resolved that a Meteorological Section be formed, with Mr. NEVINS as chairman. The party returned by train to Stoke.

II.—NORBURY AND THE WEVER HILLS.

SATURDAY, May 23rd, 1891.

LEADER.—MR. WILKINS.

The Second Excursion of this season took place on Saturday, when about fifty-five members assembled at Norbury. Once again in the history of the Club Norbury Church was visited, but with the special object on this occasion of hearing an able paper by Mr. W. Archibald Armstrong, one of the masters of Denstone College, on the palimpsest brass now in the chancel floor. Mr. Armstrong pointed out in much detail the changes which this memorial has undergone since it was first engraved and placed apparently in Croxden Abbey, whence it was removed to Norbury, and there engraved on the reverse. A short halt was made at Ellastone, often supposed to be the "Hayslope" of "Adam Bede," and various points in connection with that novel and the life of George Eliot were pointed out by the Leader. The party then drove to Wootton Hall, so well known as the retreat of Jean Jacques Rousseau. Here a paper by Mr. W. S. Brough,

of Leek, was read,* setting forth the circumstances of Rousseau's sojourn there, his quarrel with Hume, and his botanical rambles in the neighbourhood. A visit was next paid to the splendid woods around Wootton Lodge, teeming with life interesting to the botanist and zoologist. A steep climb up Beacon Stoop and a short walk on the high ground there found all members very willing to drive the remainder of the route to the Izaak Walton Hotel, at Ilam. It is needless to say very ample justice was done to the substantial tea provided at that delightful hostelry. Several new members were elected and others proposed. A hearty vote of thanks to Mr. Wilkins for his successful leadership brought the proceedings to a close, and a drive to Ashbourn Station, where all took train for their different destinations, brought to a close a most enjoyable and delightful excursion. Amongst the botanical finds were the beech fern, and the oak fern. A "badger's earth" was observed. The President (Mr. T. Wardle) referred to very distinct traces on the Wevers of glacial action, which had been brought to his knowledge by Mr. Armstrong in the course of the excursion.

III.—OAKAMOOR, COTTON, AND THE STAR WOOD.

SATURDAY, June 27th, 1891.

LEADER—Mr. BROUGH.

On Saturday morning a party of about eighty members of this Club went by train to Oakamoor, in the Churnet Valley, for the purpose of visiting the copper works of Messrs. Thomas Bolton and Sons, and the Star Wood, better known perhaps as Cotton Dell. Messrs. Bolton's works are situated in a gorge-like valley of great beauty. It can scarcely be said that they add to the picturesqueness of the spot, but at all events, they do not make that havoc among vegetation which the mere mention of copper works at once suggests to the mind. So far as we know, there is not a single process carried on at Oakamoor which is deleterious, the smelting of the copper being done at the firm's works in woe-begone Widnes. The few members of the party who remembered what the works were thirty years ago, could not fail to be struck with the great extension which has taken place in the interval. There are usually about 450 men employed there, though at the present time a considerable number are invalided by the ubiquitous influenza. In the annals of applied science the place has become famous, for the copper core of the experimental submarine cable laid between Dover and Calais in 1849 was made here, so also was that of the first Atlantic cable; and the reputation thus obtained by the firm, has led to the cores of nearly all the submarine cables in the world being sent forth from this secluded village of the North Staffordshire moorlands.

* See North Staffordshire Naturalists' Field Club Report, 1879, p 26.

The visitors were received at the railway station by Mr. Bolton and Mr. Frank Bolton, who conducted them to the works, where each was supplied with a list of the processes which were about to be exhibited. These were not fewer than twenty in number, so that we are precluded by the limited space at our disposal from going into full particulars. We may mention, however, the casting of brass ingots for sheets and tubes, the rolling of copper bars into rods for wire, the drawing of thick and fine wires, the stranding of wire for electric light cables and lightning conductors, the testing of wires for telegraphs and telephones, the tinning of copper wire, the rolling of brass and copper sheets, the forging of copper billets for calico printing rollers, the making of brazed brass and copper tubes, and the drawing of seamless brass and copper tubes. The machinery employed is very ingenious and very costly, so that one earthenware manufacturer was heard to remark in slightly envious tones, "There's no chance for little men to get into this business with cutting prices." In the way of rods and wire anything can be turned out, from a rod two inches in diameter to a wire the one-thousand part of an inch in thickness. This last, specimens of which were distributed, is finer than human hair, and is used for delicate electric instruments, and for weaving into wire cloth, &c. A good deal of fine brass wire is used for the wire cloth which plays so important a part in the manufacture of paper. One of the most recent improvements in the manufacture of copper is the extraction of the silver which exists in the ore. The presence of silver made the manufactured copper brittle, but now that it can be removed the increased ductility of the copper has much increased its value, to say nothing of the silver obtained. It may be added that there were copper works at Oakamoor a hundred years ago, and that they owed their origin to the facts that copper ore was then obtained in the neighbourhood, that there was coal to be had as near as Cheadle, and that valuable water-power was furnished by the Churnet.

At the close of the inspection of the works, the members were very kindly invited by Mr. Bolton to take luncheon at his residence, Moor Court, which is situated on the eastern side of the valley, about half-a-mile from the works. There the visitors, who were welcomed by Mrs. and Miss Bolton, found an elegant and beautiful luncheon spread in a large marquee. The repast having been leisurely enjoyed, Mr. T. WARDLE, F.C.S., F.G.S., President for the year. rose and said that had the June Excursion of the Club come to an end, it would have been one of the most agreeable and instructive ever undertaken. It gave him much pleasure to propose a hearty vote of thanks to Mr. and Mrs. BOLTON, Miss BOLTON, and Mr. FRANK BOLTON for their great kindness, and to congratulate the firm on the success of their efforts to draw the ends of the world together. Thanks mainly to the energy and ability of Mr. Bolton. the means of electrical communication went forth to all parts of the world from Oakamoor. Mr. J. R. B. MASEFIELD in seconding the vote of thanks, said he happened to know that on the previous Thursday morning Mr. and Mrs. Bolton had no idea they were about to receive so large a party, but on becoming aware of the fact, they telegraphed right and left for the marquee and other things with the result they had all seen and enjoyed. Mr. Masefield referred also to the leading part which Mr. Bolton had taken as a member of the County Council in promoting technical instruction. This had resulted in Cheadle and Oakamoor being first in the field with lectures on mining and agricultural matters. The Club was also indebted to Mrs. and Miss Bolton for their efforts to preserve the wild flora and fauna of the district, which was one of the specific objects set

forth in its rules. The vote having been carried by acclamation, Mr. BOLTON replied. In the course of his remarks he gave a little sketch of the principal undertakings carried out at the works, and created amusement by expressing the hope that science would not go a-head so fast as to render communication with distant places possible without the aid of copper wire. He expressed the hope that the Club would not allow another sixteen years to pass before they visited him again, and also that the efforts they were making to teach people to preserve instead of ruthlessly destroying wild plants and animals would be successful. He also made a few remarks on the benefits of technical instruction. A hearty vote of thanks was also given to Mr. W. S. BROUGH, the Leader of the Excursion. After this several new members were admitted, and a number of nominations to membership were made.

The party then walked up to St. Wilfred's Roman Catholic College, and thence through the lovely Cotton Dell, the natural charms of which have been increased by the planting of many additional wild flowers by the Very Rev. Canon Hawksford, the Principal of the College. The principal plants were Linaria cymbalaria, Myrrhis odorata, Valeriana pyrenica, Petasites albus, and Pimpinella magna. The weather was not favourable to the entomologists. Redstarts in some abundance, and nests of the same birds were observed. Some of the party returned to Oakamoor *via* Leek, at six o'clock, while others walked on to Alton Towers, and reached Stoke by a rather later train.

IV.—THE DUKERIES

WEDNESDAY, July 29th, to MONDAY, August 3rd, 1891.

LEADER.—MR. WARDLE, PRESIDENT.

The excursion tickets were issued from various local stations to Worksop Station, via Manchester and Sheffield. About thirty members availed themselves of this opportunity, and rooms were furnished at the Lion and Royal Hotels, Worksop, where, with a few exceptions, the whole party were comfortably lodged.

To render a lengthy and detailed description unnecessary, a simple re-print of the programme, which is a descriptive one, is substituted, with the addition of a few explanatory remarks.

Roche Abbey and Valley proved to be well worth a visit. The details of early Gothic ornament were very numerous and the ruins of the Abbey itself, of the highest interest. Fragments of old stained glass were found.

Clumber House was visited twice; tickets for service in the beautiful Church in the grounds being most kindly provided by Mr. J. Haslam. Both the exterior and the interior of the Church are most beautiful. The

party attended the Communion Service on Sunday morning, which was chorally rendered, and in every way worthy of its surroundings. After Church we had lunch at an adjoining Inn, just outside the Park, and spent the afternoon most agreeably in the Forest.

On arriving at Worksop, the Vicar of Worksop met the party at the Priory Church. He gave us some information of its history, which is as interesting as the old Norman building itself. A portion of the Cloisters remain. The antiquities of Worksop consist of the Priory Church (the nave only being now left, the choir and transepts being swept away); a 13th century St. Mary's Transept-Chapel in ruins, and a splendid Gate-house of the 14 century, with remains of an old 12th century market cross in front of it.

PROGRAMME.

On THURSDAY: *Drive to Roche Abbey*, by Shireoaks, eight miles from Worksop; a charming drive. The ruined Abbey is picturesquely situated in a valley, bounded by perpendicular crags of magnesian limestone.

Roche Abbey was occupied by Cistercian Monks originally, probably from Dijon, dissolved in 1538, and afterwards left to go to ruins; it now belongs to the Earl of Scarborough who cares for it, though late; other objects of interest, charming views on approaching the Abbey, bold wooded heights, tree-crowned crags, wild flowers, ferns and luxuriant vegetation, the table-rock and wishing spring, beautiful lake on plateau above the Abbey.

FRIDAY: *The Dukeries.*—1st, Welbeck Abbey and Park, the seat of the Duke of Portland, Master of the Horse to the Queen.

Objects—Greendale Oak (if time permits), 1,500 years old, cut through so as to enable a carriage to be driven through its bole, the Porter Oak and others, underground carriage-way to the house, lit with gas or from glass lighting in the avenues above ground, underground Riding School, Tan Gallop, and Picture Gallery, the Chapel, Drawing Rooms, Gothic Hall, State Boudoir, Music and other Rooms magnificently furnished and adorned with numerous art treasures in tapestry, pictures, carving, pottery, and other historical objects. Outside the house—Lake three miles long, Extensive Hunting Stables, Conservatories, Vineries, and Peach-houses.

Then drive through the Duke's private drive, through the grand and impressive South Sherwood Forest of ancient and modern oaks and silver birches, past the "Butcher's Shambles" Oak or Robin Hood's Larder, where Robin Hood is said to have hung his venison, on hooks still to be seen; if time permits, the ruins of King John's Palace at Clipstone, the "Parliament" Oak, under which a council of Barons was held under King John when the Welsh rebelled, on to lunch at the delightful village of Edwinstowe, where Edwin, King of Northumbria, is said to have been killed, in 633, and where the Norman Church stands, the famous "Major" or "Queen" Oak, the Simon Forester Oak, etc.

After lunch, up to Rufford Abbey, once a Monastery, now the large baronial residence of Lord Savile.

Objects—Avenue of limes and beautifully-wooded grounds, Lake, Gateway, inside the Long gallery, fine Drawing and other Rooms, pictures, Snyder's celebrated Boar Hunt.

Then back through another portion of the South Eastern part of Sherwood Forest known as Bilhagh, the picturesque village of Budby, and through Thoresby Park, part of the extensive lake fed by the river Meden, to Thoresby House, the seat of Earl Manvers.

Objects—Most beautiful drive through the heart of Sherwood Forest, magnificent oak, beech and silver birch, exterior of mansion. The interior is closed to visitors owing to extensive structural alterations. The pleasure grounds may be seen, but those of Clumber are much more extensive. Thoresby Park is twelve miles in circumference.

Drive to Clumber House, the famous seat of the Duke of Newcastle, crossing the broad boundary line separating the estates of Thoresby and Clumber, and pass Normanton Inn, and the Kennels with the packs of wolf-hounds and Clumber spaniels.

Objects.—Park of 4,000 acres, eleven miles in circumference. House built in 1770, lake of 87 acres, terraces, lawns, gigantic and beautiful trees—cedar, yew, pine, beech, birch, and oak. Exquisite Church by Bodley and Garner, perfect in all its parts and fittings. In the House, most valuable pictures, statues, marble chimney-piece from Fonthill Abbey, and many other objects of art and vertu. Then drive down the lime tree avenue, and back to Worksop by seveno'clock.

SATURDAY.—*Steetley.*—Saxon and Norman Church of great Archæological interest. Cresswell Crags of magnesium limestone, Bone Caves under exploration, rare plants. Bolsover Castle, the ancient strongholds of the Peverils.
Objects.—The ruins of both the ancient and modern buildings. Castle walls, magnificent views, Norman Parish Church with monument.

Drive on to Hardwick Hall, built by Bess of Hardwick, in 1587.

Objects.—The fine Elizabethan House, "Hardwick Hall, more glass than wall," 300 feet across its front, magnificent apartments. Picture Gallery, Presence Chamber, Library, Grand Staircase, Bedroom of Mary, Queen of Scots, very fine ancient Gobelins, Tapestry, &c. Drive back to Worksop by Mansfield.

SUNDAY.—There are excellent Services in the fine Priory Church at Worksop. At Clumber Church, those who delight in elaborate ritual will revel in its elaborations, into which music, vestments, incense, and the fullest developments of Anglican ritual have been fully called into aid.

MONDAY.—For those who can stay to see more, Southwell may be visited, or a quieter return by Sheffield, where a stoppage may be made to see the Ruskin Museum. This can be discussed at Worksop.

V.—BOSWORTH FIELD AND SHENTON CHURCH.

THURSDAY, August 27th, 1891.

LEADER.—Mr. F. GEE.

The Fifth Excursion of the season took place by invitation of Mr. F. Gee, of Atherstone. About forty-five ladies and gentlemen proceeded to that place by the 9-35 a.m. express from Stoke, which was specially stopped at Atherstone. Here they were joined by Mr. and Mrs. Gee, and a few other members and friends. The Church was first visited; it was rebuilt about forty years ago by the late Vicar, at whose instance the chancel, which for three centuries had been secularized, having been partitioned from the rest of the Church and used as a school, had been lately completely restored, and recovered to its ancient and sacred uses. It was formerly a chantry, and belonged to an adjacent priory; the conventual buildings have entirely disappeared—and it is said that Atherstone Hall, which formerly was the seat of the Bracebridge family, and now belongs to the Rev. Berdmore Compton, M.A., late Vicar of All Saints', Margaret-street, London—was some two centuries ago built from the ruins. It was in this chancel or chantry that the Duke of Richmond received the Blessed Sacrament the day before the battle of Bosworth Field. The Vicar, the Rev. W. Northcott, M.A., and Mr. W. Wilson, one of the churchwardens, and a member of the Club, kindly exhibited in the vestry some ancient deeds, *temp.* Oliver Cromwell and Charles II, which for many years had laid unnoticed in an iron safe, one of the keys having been lost.

After the Church had been inspected, and the Vicar and churchwardens congratulated on the recovery of the ancient chancel, which is, by the way, of the Perpendicular period at its best date, the party proceeded in carriages to Shenton Church, passing on their way Atherstone Hall, and crossing the river Anker, which separates the two counties of Warwick and Leicester. The route lay through Ratcliffe Culley, and just under Sibstone, of which villages the churches are both ancient and interesting, but there was no time for paying any attention to them. Shenton Church, which lies at the edge of the battlefield, has been rebuilt by the Wollaston family of Shenton Hall, which was erected in 1629. Some brasses and a monument from the old church have been preserved. The oldest of the former is an inscription of the date 1556, and is admirably lettered. Half-a-mile from the Church the carriages deposited the party on the battlefield, and after visiting King Richard's well, from which he drank his last draught before rushing down the high ground of Amyon Hill in quest of his ruthless foe the Duke of Richmond, and which has been covered by a pyramidal structure of rough stone, bearing a Latin inscription, said to be from the pen of the celebrated Dr. Parr. It was in this onslaught that Richard lost his life, and his battered hemlet, bearing a crown or fillet of gold, was afterwards picked up out of a bramble-bush into which it had been thrown; and Henry was crowned with it on what is now called Crown Hill, a short distance from the village of Dadlington. On the summit of Amyon Hill, a little above the well, some welcome refreshment was

hospitably brought out by Mr. Abel, who farms the land on which the field of battle is situated, and an excellent map on a large scale, showing the disposition of the forces, was exhibited by his neighbour, Mr. Parker.

The Leader, Mr. F. GEE, now read a paper on the battle, the large map spread on the grass well illustrating his excellent description of it. Mr. Gee showed by what routes the four armies of Richard III, Henry Duke of Richmond, Lord Stanley, and his brother, Sir William Stanley, marched to Bosworth Field, and the positions they took up the night before the battle, which was fought on the 22nd day of August—equivalent to our September 2nd—1485. As is well known, the defeat of Richard was compassed through the defection of Lord Stanley and his brother, who had covenanted with the Duke of Richmond to take no part in the battle unless they saw that he was pressed. A hint of this treacherous compact was conveyed to the Duke of Norfolk, who was slain early in the engagement. Fastened on his tent was found on the morning of the battle, a paper with the well-known couplet—

> Jockey of Norfolk, be not too bold,
> Dickon, thy master, is bought and sold.

Three thousand men fell in the battle, including several others of England's nobility. It was the last of the thirteen battles of the Wars of the Roses, the first being that of Blore Heath, in Staffordshire. It was decisive in its results, and from that date the old feudal system declined.

After a hearty vote of thanks, proposed by the Rev. T. W. DALTRY, Secretary of the Club, to Mr. Abel and to Mr. Parker, for their kindness and hospitality, the carriages were re-sought, and a short drive brought the party to the little village and church of Dadlington. The churchyard here being the nearest consecrated ground to the battlefield, many of the slain were brought hither for interment, and the sexton related that some forty years ago, in making a grave, a large pit was discovered, twenty-two yards by eighteen yards, in which was a deep layer of human bones, the bodies having evidently been placed one on the other to a considerable depth. And this he had himself seen when a boy. There can be no question these were the remains of the men of Bosworth Field. The Church of Dadlington has quite recently been well restored. It has an ancient timber porch, about 400 years old, the door of which, with its original ironwork and well-executed carving in a line along the top, has been removed into the tower, and separates it from the west end of the church. The architecture is Early English, of which date there is a piscini and a double sedilia On the south side is an aisle, or rather chapel, which has had its own altar, and is of late Decorated work. The piscina still exists. On the outside of the chancel, built into the east wall, is a fragment of dog-tooth moulding which belonged to the original Early English Church.

Departing hence, the carriages stopped at Crown Hill, mentioned above, a quarter-of-a-mile further, which some of the party visited ; then they went on to Stoke Golding, the church of which is very fine, and to archæologists most interesting. Like Dadlington, which is a chapelry under it, it was originally an early English Church, some walling and a lancet window on the south side of the altar alone remaining of it. The nave and its aisle are of the Decorative period : the piers, arches, and windows are of excellent workmanship, very bold in design and highly ornamented, the windows of the aisle being of an earlier date than those of the

nave. The font, too, is of much the same date, and is highly ornamented with figures and tracery on its eight sides. Originally, there were three altars; a double piscina at the east end of the aisle is very fine. The tower and spire are, like the greater part of the church, of the Decorated period. In an adjacent wall is inserted an earlier window, which is said to have been dug up near the east end of the church. It belongs to the very earliest Decorated period, and there is an entire absence of cusping.

Stoke Golding being about five miles from Atherstone, and time pressing, a move was quickly made to the carriages, and no further stoppage was allowed, although the route lay past a well-defined tumulus, with oak trees on it, and through Fenny Drayton and Witherley, where there are very interesting churches, the latter having a fine Decorated tower and spire, which are conspicuous objects from the London and North-Western Railway, a little south of Atherstone, on the left. Between these two villages is the cottage in which Fox the Quaker was born; and hard by, at a turn of the road, a small pillar has been erected to his memory. Here, too, the Watling Street was reached, and the remainder of the route lay along it; the road passes right through the Roman Camp Massevedunum, now called Mancetter, the church of which place was visited by the Club during their first excursion to Atherstone on April 20th, 1887. The vallum of the camp still exists, although much levelled down. This was the winter camp of the Roman troops; the summer camp was on Oldbury Hill, about two miles away to the west. There are here also considerable remains of the vallum, and the four entrances can be traced. After passing through Massevedunum, Atherstone was soon reached, the new Grammar School buildings forming a prominent object at the entrance of the town. The carriages deposited the party at the hospisable house of Mr. and Mrs. Gee, where under the shelter of a tent, a sumptuous luncheon awaited them. After doing ample justice to which, a general meeting of the Club was held, under the chairmanship of Mr. DALTRY, one of the Vice-Presidents. The CHAIRMAN invited the members present to give their hearty thanks to Mr. and Mrs. Gee for their unbounded hospitality, which for the second time they had shown to the Club, and to Mr. Gee also for his excellent paper on "Bosworth Field." This was seconded by Mr. ALEX. SCRIVENER, and carried amid loud applause. The vote of thanks was acknowledged, first by Mrs. Gee and then by Mr. Gee, who spoke at some length. It was now nearly 5-30 p.m., at which hour the return train was timed at Atherstone, so that an intended visit to Mr. William Wilson's hat manufactory had to be abandoned. The excursion was in every way most successful, except as regards weather. It rained more or less all the day and the ground was very wet. On the last stage of the journey the rain came down very heavily indeed for a quarter of an hour. For once, the Club did not meet with its usual good fortune in this respect; nevertheless, the programme was fully carried out except as to its last item.

VI.—MANCHESTER SHIP CANAL.

THURSDAY, September 17th, 1891.

LEADER.—Mr. BARKE.

The Sixth Summer Excursion of this Society was made on Thursday Sept. 17th, members leaving Stoke by the 8-25 train, and arriving at Runcorn at 10 o'clock. The Leader for the day had chosen the western end of the canal for inspection, and it must be admitted, had sketched out a pretty stiff day's work for the members. Nothing daunted, about eighty turned up, of whom ten were ladies, and set off cheerfully along the banks of the canal for Ellesmere Port, a distance of nine miles. The party was met at Runcorn by Mr. Ward, of Manchester, whose services had been retained to act as guide. Fortunately the weather was fine, though somewhat cloudy. The length between Runcorn and Weston Point is open to the tidal waters of the Mersey, and presented a very busy scene as the ships were being towed into dock to discharge their cargoes, no small portion of which, it was remarked, was destined for the Potteries. The land or south side of the canal is chiefly occupied by docks, and the north side is being formed by the construction of an embankment in the Mersey. The mode of procedure is as follows :—Boats containing stones are towed into position at high water, and allowed to strand as the tide goes out. Their contents are then deposited in the bed of the river in two rows, which are intended to support the embankment on either side. Dredges are then brought to work to scoop out the mud from between the lines of stones, and when a sound bottom is reached, clay, etc., is pitched into it by means of a temporary railway, which is brought along as the bank proceeds, and the embankment brought up to its proper height. The sides are then pitched with heavy blocks of stone, to enable it to withstand the action of the tides When this work is completed, the space between the north and south walls will be dredged out to the required depth. The party partook of luncheon at the hotel at Weston Point, and proceeding, passed through the workshops, where the massive dock gates were being made. These gates are constructed of wood called Greenheart—*Nectandra rodiæi*—which is grown in British Guiana.

The next point of special interest was the Weaver sluices, which are ten in number, and comprise immense piers of masonry, between which are hung huge iron gates, which can be raised and lowered by means of hydraulic pressure. So nicely is the balance adjusted, that these ponderous gates can be moved up and down by one man. The sluices will form part of the outer wall of the canal, which at this point will divide the estuary of the Weaver from the Mersey, and they are constructed for the purpose of allowing the water of the Mersey to pass in and out of the Weaver with the flowing of the tide. Adjoining the sluices is the tidal opening, over which is an open framework of timber, supported on piles. A couple of planks placed side by side along this framework form the only means of reaching the opposite bank—a distance of perhaps 100 yards. This might have proved rather a trying ordeal for weak nerves. The

receding tide was flowing over the sill some forty feet below, and a stiff breeze blowing from the Mersey. But the party was equal to the occasion, and gained the opposite bank in safety. Surely the engineers might erect a handrail across this gantry for the safety of their workmen, to say nothing of visitors.

They now entered another section of the canal, which is so far advanced towards completion that the water is being let in. A heavy swing bridge at present blocks this end, but through it ships will pass to and from the Weaver.

Gangs of navvies are engaged at several points, completing the embankment, diverting water-courses, etc., notably at the river Gowy, where a syphon conducts this stream under the canal into the Mersey.

Work was in full swing at Ellesmere Port, where steam navvies were beginning to remove the dam, through which the water was being admitted into the Ince section by means of a pipe four feet in diameter. The filling of this long section is necessarily a slow process, and will take many days to accomplish.

From Ellesmore Port to Eastham the Canal is already opened for traffic, and a steamer was in waiting to convey the party along this section. Here was the crucial test. Were the Naturalists equal to the task which they had undertaken, and would they come up to time when the steamer sounded the whistle? We are bound to admit there were a few laggards, though the bulk of the party were well to the fore. A few ardent botanists had lingered to examine the spoil banks, already covered with what to the uninitiated were simply weeds, but which yielded to the practised eye of the botanist, treasures of no mean value. The entomologists too were not sent empty away. Still behind these was a small contingent who came up somewhat fagged with what had undoubtedly been a trying walk. We think, however, that the result reflects great credit on the Club, and proves to demonstration that it still posseses the vitality of youth. A good view of the great training wall across the bay was obtained from the steamer. Numbers of masons were busy on it, and steam cranes at work placing the great blocks of stone, for pitching the sides in position. The possibilities of a great future for this truly gigantic undertaking arose before the mind, when the south bank should be covered with wharves and warehouses, and all the busy appliances of commerce.

The great locks at Eastham being reached, the party disembarked and walked to the Ferry Hotel, where a substantial tea was provided. The little delay before alluded to was now felt, as only half an hour was left in which to satify the cravings of hunger, it being necessary to catch the five o'clock boat for Liverpool. The usual business of the Club had to be done *en route* in one of the three saloons in which the party travelled. The connection at Crewe was duly caught, and the party arrived at Stoke by the last train, and so ended a very enjoyable and instructive day's outing.

VII.—TUTBURY AND FAULD.

TUESDAY, October 20th, 1891.

LEADER.—MR. MASEFIELD.

The last Excursion of the season of this Club took place on Tuesday, to Doveridge. Sudbury, Fauld Gypsum Mines, Hanbury, and Tutbury. About thirty-five members proceeded by train from Stoke to Uttoxeter, where carriages were awaiting the party, and a most enjoyable drive on a fine autumn morning was commenced.

The first halt was made at Doveridge Church, where the Vicar (the Rev. R. Hamilton) kindly conducted the party through the church, pointing out the architectural points of interest, and especially the portion of an early 13th-century cross in the churchyard and the enormous yew-tree, heavily laden with its bright-red berries. After a hearty vote of thanks to the Vicar, the party drove on to Sudbury, where Archdeacon Freere and his curate kindly met the visitors and conducted them over this "perfect specimen of a little country church," as one of the members truly called it. In the Vernon Chapel two early recumbent figures of great beauty and thoroughly typical of their date were specially noticed. The Archdeacon also produced the extremely interesting Communion plate for examination, and it was much admired. In the churchyard the flowering and fruiting of many species of cedar and pine created great interest amongst the botanists, and diligent search was made to find some of the minute male and female flowers on the different trees. After thanking the Archdeacon and his curate the party perambulated the grounds around Sudbury Hall, and then, after a hurried luncheon, proceeded to Fauld, calling at Sudbury Station *en route* to pick up members who had arrived by the later train.

On arriving at the Fauld Gypsum Mines, the visitors were welcomed by Messrs. Newton and Staton and their assistants, and after lamps and candles had been distributed, the search through these much interesting mines commenced. The workings are all on the level, and are of great extent, piercing the hill in all directions wherever the beds of gypsum are found to lie. After a walk of about a quarter of a mile underground, the party halted in front of the finest deposit of the mineral where the huge blocks are quarried for church use, etc. The mineral *in situ* is charged with a large percentage of water, giving it a grey appearance, with marl-coloured veins and streaks running in every direction. On holding a light behind a lump of the mineral its beautiful transparency became evident.

Mr. Barke here read a valuable paper on the gypsum deposit.

The lessees, Messrs. Newton and Staton, had kindly illuminated the passages of the mine, and the various interesting spots were shown by means of magnesium lights. The next point of interest was the getting of the mineral for making cement, plaster of Paris, etc., and the party

were conducted to the face of the working where the workmen were at actual work, and the mode of drilling and blasting, etc., was fully explained. The party then returned through other portions of the workings, halting here and there to admire the curious and beautiful growth of fungi on the timbering of the mines, and then emerged on the opposite side of the hill to that in which they had entered.

From this point some portion of the party took the direct route across the fields to Tutbury, whilst the rest climbed the hill to Hanbury Church, kindly thrown open to inspection by the Rev. J. R. Foot. This Church has been beautifully restored, and, with its ancient monuments and modern pulpit, font, and reredos, all of alabaster, and the wall frescoes in the chancel, is one of the most beautiful churches in our county. Time pressing on, only too quickly to please the members, they then again took their seats in the carriages and drove to Tutbury. Here the Castle and Church (by the kind permission of the Rev. J. T. Chippendall) were visited, and the splendid west doorway, and the ancient Norman pillars of the Church called forth expressions of great admiration. Next came the plaster and cement works of Messrs. Staton, which were shown by the kindness of the owners. The gypsum from Fauld is here crushed and converted into plaster of Paris, and cement for potters and builders' purposes, and the different processes through which it passes were clearly explained by Mr. Henry Newton, who throughout the afternoon had done all he possibly could to interest the visitors. They had to forego the pleasure of a visit to the Tutbury Glass Works, and an inspection of a collection of bird skins in Mr. Newton's possession. Late as it was in the year, the botanists succeeded in finding the following rare plants :— *Sambucus Ebulus*, *Pimpinella magna*, *Inula dysenterica*, *Arenaria serpyllifolia*, and *Ballota nigra*.

Darkness coming on, the party were obliged to adjourn to tea at the Castle Hotel, where they enjoyed a capital repast. The election and nomination of new members followed, and the usual votes of thanks were passed to the Leader, and all others who had so materially assisted in the success of one of the most enjoyable excursions of the year. Great regret was expressed on all sides at the absence of Mr. Lynam, who was confined to his bed with a severe cold. He had already gone over the ground, and promised to explain the architecture of the various churches, but was obliged to be content with sending some valuable notes on the subject. The President, Mr. T. Wardle, was also prevented from attending through illness. All wished them speedy recovery. The party returned home in two saloon carriages from Tutbury Station by the 7-24 train.

EVENING MEETINGS.

I.—HANLEY.

WEDNESDAY, November 18th, 1891.

The First Evening Meeting of the Winter Season took place in the Technical Museum Galleries at Hanley, on Wednesday evening. In the unavoidable absence of the President, (Mr. T. Wardle, F.G.S.) the chair was taken by Mr. W. D. Spanton. There was a moderate attendance of members. A Paper on "Botany as a science and recreation; with notes on some of the plants found in the Biddulph district" had been prepared by the Rev. W. Hunt Painter, who was unable to attend. It was consequently read by the Rev. T. W. Daltry, the Secretary. Numerous specimens of plants were exhibited, and the writer supplied remarks concerning each of them.

Mr. J. YATES moved a vote of thanks to Mr. PAINTER for his interesting paper, observing that it was one which needed to be carefully studied, because it supplied to botanists a good deal of matter for consideration. Mr. MASEFIELD seconded the motion. He observed that they frequently saw baskets of local ferns and wild flowers brought to the markets to be sold. They enjoyed seeing the ferns growing as they passed along the roads, and he for one would set his face against encouraging the stripping of the country of ferns. He never would buy a basket of them. The resolution was carried.

Mr. W. BURTON, F.C.S., delivered an address on "Foraminefera." He showed several diagrams containing magnified views, illustrative of the simplest forms of life, and by the aid of these illustrations he made the address exceedingly interesting. He said that at the beginning of this century there were only ten or twelve known species of the Foraminefera, but now there were over six hundred. It had been ascertained by dredging in parts of the Indian Ocean, the Atlantic, and the Pacific, that there were countless myriads of shells of these tiny creatures, and small and insignificant as they appeared, they were yet capable of attaining bulk, and in long periods of time of effecting astonishing results.

Mr. W. HAMPTON moved a vote of thanks to Mr. BURTON for his very interesting address. This was seconded by Mr. F. BARKE, supported by Mr. E. J. HAMMERSLEY, who remarked that in Mr. Burton the Club had a most valuable new member, and carried unanimously. The Chairman was thanked for his services, on the motion of the Rev. T. W. DALTRY, seconded by Mr. E. EARL. Microscopes were lent by Mr. AUDLEY, Mr. W. BURTON, and Mr. W. HAMPTON. Mr. SALMON showed curiosities from India, and Mr. JAHN lent some plants and flowers which had been dried by sea-sand, and various Natural History specimens.

II.—LEEK.

SATURDAY, January 21st, 1892.

The members held the Second Evening Meeting of the Winter Session on Saturday. About forty members left Stoke by the 2-50 p.m. train, while several others joined the party at Leek and at intermediate places. At four o'clock the members were received at the Nicholson Institute by the President, who invited an inspection of his remarkable collection representing the arts and crafts of India. These, it will be remembered, were collected by him in 1886, when he received a commission from the Government to collect silks for the Royal Commission of the Colonial and Indian Exhibition, and to report upon the silk districts of Bengal. The exhibits were arranged with much taste, and at no small amount of trouble, in four rooms at the institute. In the Lecture Hall the walls were hung with a large collection of rich and costly Indian textiles, chiefly consisting of embroideries, silks, and cotton prints. The embroideries were particularly rich in colour and design, and included specimens of phulcari flower-work, ornamented with small circular mirrors, which produced a brilliant effect. Two very large Madras prints, representing the Hindoo religion, were also shown, besides a number of specimens of costly kinkhab table cloths most skilfully woven with pure gold and silver thread. There was besides a large collection of chintz printing-blocks. On the centre table there was an interesting collection of specimens of sculpture. brass-work, and wood-carving. The sculpture exhibits consisted of portions of the ruins from the temple of Buddha at Buddha-Gaya. The brass-work included specimens of Bidri workmanship, with silver in-laid, chiefly representing mythological figures. Some fine examples of carved teak, taken from an old 17th-century house at Baroda, were also to be seen, besides a few specimens of Bombay pottery. Passing to another room, the members inspected a miscellaneous collection of the textile fabrics, including two embroidered sheepskin coats made at Peshawar, and worn by the hill tribes in the Khyber Pass and other parts. An interesting case of tinsel envelopes, with seals attached, in which the Princes of India send their official and other letters to Government and each other, and a fine collection of architectural and rural landscape photographs, were also exhibited. Another interesting exhibit was a bi-coloured net or marriage robe. It consisted of a thin gauze, curiously dyed red on one side and green on the other, ornamented with crescents and a rich embroidered border. In another room there was a large collection of Indian birds shot by Mr. Wardle, cases of Indian silk-producing lepidoptera in various stages, a large variety of Tussur silks, and numerous specimens of Indian plants. In yet another room were shown cases of Indian jewelry, arms, and many other objects of interest. Here was also to be seen at work a machine representing the Italian system of reeling cocoons with "travelette keeler," which was introduced by Mr. Wardle into Bengal.

At half-past four the PRESIDENT took the chair, and in welcoming the members to Leek he said he was glad to see the Club increasing in membership. He felt sure they might look forward to substantial growth, as the coming time seemed full of every kind of scientific and artistic education, and the Club had a very useful work before it.

Dr. ARLIDGE then read a paper on the late meeting of the British Association at Cardiff, pointing out how the Club could co-operate with that great society by recording in the section of geology the position, origin, composition, and markings of erractic boulders; the noting of earth tremors, and making of observations on underground waters, and the photographing of sections and other objects; biology, by noting and preventing the disappearance of native plants, and the destruction of the eggs of wild birds; the investigation of the invertebrate fauna and of cryptogamic plants, and the cataloguing of specimens in local museums; and in anthropology, by the noting, photographing, and cataloguing pre-historic remains; excavating caves, and other places of habitation of ancient man; and the preservation from destruction of both pre-historic and historical monuments.

The PRESIDENT, in moving a vote of thanks to Dr. Arlidge for his paper, said he was sure the committee would not fail to act upon the suggestion given in his interesting paper. Mr. C. Lynam seconded the proposition, which was carried with acclamation, and Dr. Arlidge replied. The PRESIDENT said he understood there was a proposition to pull down the fine old 13th-century tower at Newcastle. It was one of the most venerable monuments in the county. They loved to regard their ancient buildings, and to trace in them their ancient religion, and any proposition to demolish one of them would be most jealously watched by that society. Mr. LYNAM said he understood that Mr. Stanier had generously offered to re-build the tower, but what that meant it was not easy to say. From what he knew of Mr. Stanier, he believed he would be reluctant to do anything which would involve an archæological loss to the county.

The PRESIDENT then invited the members to a substantial tea at the Red Lion Hotel. At the close of the meal a hearty vote of thanks was passed to Mr. Wardle for his hospitality. The members subsequently re-assembled at the Nicholson Institute, where they were joined by a number of residents in the town. A short address was given by the PRESIDENT descriptive of the exhibits. He said India could scarcely be said to have any fine arts, although the people were wonderfully skilled in decorative art. Everything bore evidence of how they loved to beautify anything they lived with and amongst. Their architecture, especially the ancient types, was perfectly wonderful. He had never seen any grander or more beautiful. Their sculpture and wood-carving was of the most beautiful and minute character. Their work in metal was also very wonderful. With regard to the textile arts, all over India there was an enormous amount of embroidery done. Nearly all the work was hand work. They did not know what machinery meant, although they were beginning to learn its use, to the great decadence of their art. Nearly every piece of their embroidery had a border to it, which as a rule was a perfect study in design. They had also made a great study of dyeing. Their colours were rich in tone, and permanent. He believed there was a great future for Indian silk, and he saw no reason why India should not become the great emporium for that article. In Cashmere, for instance, there were greater facilities for successfully producing silk than in any other part of the world. It was a perfect garden of mulberry trees, and so numerous were the silk-worms that they had become quite wild.

Mr. T. J. SMITH then read a long and exhaustive paper on the history and biology of bees.

At the conclusion of the paper, which was listened to with interest, Mr. CHALLINOR moved a vote of thanks to Mr. Wardle for his address and to Mr. Smith for his paper. This was seconded by Mr. S. UNWIN and carried.

The PRESIDENT, in reply, acknowledged the assistance rendered by Mr. Unwin, the Local Secretary, in organizing the meeting, and after the members had been invited to partake of refreshments, the company dispersed, most of the members returning by the 9-6 p.m. train to Stoke.

III.—NEWCASTLE.

THURSDAY, February 18th, 1892.

On Thursday evening, the members met for their third meeting of the winter session, which was held in the Municipal Buildings, Newcastle. There was a good attendance. Before the business of the meeting was commenced, the members were afforded an opportunity of inspecting a number of interesting exhibits, the principal of which consisted of a large collection of minerals, chiefly illustrative of the mineralogical forms of silica and silicates, shown by Mr. W. Burton, F.C.S. The collection was arranged in about a dozen groups. Mr. W. H. Earl showed a fine collection of coins, including a set of Jubilee silver, cases of moths and shells, and a number of early copies of London Gazettes and news-sheets. Mr. J. Kirkby exhibited a collection of pre-historic flints, and two ancient British urns dug up at Trentham. The President, Mr. T. Wardle, F.C.S., F.G.S., occupied the chair, and explained that the meeting was to have been held at Stafford, but owing to the prevalence of influenza it had to be abandoned. Their gratitude was due to Mr. W. H. Earl for having arranged the meeting at Newcastle. Mr. J. R. B. Masefield, M.A., then read an interesting and able introductory paper on local reptiles. The President observed that when in India he had several opportunities of studying the habits of reptiles. On one occasion, he saw the open spaces in the jungle covered with the skins of snakes measuring from six to twelve feet long. This was during the period of hibernation. He also saw a variety of lizards, and it was very amusing to watch the tiny lizards darting across the ceilings of bungalows and killing the moths which alighted.

Dr. McALDOWIE moved a vote of thanks to Mr. MASEFIELD for his paper, which was seconded by Mr. KIRKBY, and carried amid applause.

Mr. C. LYNAM, F.R.I.B.A., next read a paper entitled "A few jottings on some Staffordshire Camps." On the conclusion of the paper, the Rev. T. W. DALTRY proposed and the PRESIDENT seconded a vote of thanks to Mr. LYNAM for his paper and to Mrs. LYNAM for her sketches of the Camps, with the aid of which Mr. Lynam illustrated his paper. The resolution was carried unanimously, and Mr. LYNAM briefly acknowledged the compliment.

The PRESIDENT next proposed a vote of thanks to Mr. BURTON, Mr. EARL, and Mr. KIRKBY for the loan of their exhibits, which were cordially agreed to.

The PRESIDENT intimated that a communication had been received from the Palæontographical Society of London, inviting the Club to become a member of the Society. The annual subscription would be a guinea, and the Society offered them fifteen volumes of their Transactions as a gift on their becoming associated with the Society. He suggested that the Club should at a future meeting consider the advisableness of entertaining the offer. The proceedings then terminated.

IV.—ANNUAL MEETING, STOKE.

THURSDAY, March 17th, 1892.

The Twenty-seventh Annual Meeting was held at the North Stafford Hotel, Stoke. The President, Mr. T. Wardle, F.C.S., F.G.S., occupied the chair. The Hon. Sec. read the report of the committee. On the motion of Mr. BARKE, the report was adopted.

Mr. J. KIRKBY stated that the amount at present received on account of the "Garner Memorial" was £66 14s. 3d. Mr. James Yates was elected an Hon. member, and Mr. J. A. Audley was appointed chairman of the Botanical Section. It was decided that Stafford be constituted one of the towns at which Evening Meetings are held, and Mr. W. H. Ridge was appointed Hon. Secretary. Mr. W. H. EARL stated that at a meeting of the Library Committee, it was resolved to recommend that the books in the Library of the Club be deposited in the Hanley Free Library. This matter led to a long discussion, Mr. SPANTON moving a resolution in accordance with the recommendation of the committee. This was seconded by Mr. EARL. Mr. MASEFIELD moved an amendment that the Library be deposited with the Stoke Free Library, and this was seconded by Dr. ARLIDGE. It was explained that the books would remain the property of the Club. The amendment was carried.

Dr. ARLIDGE, in proposing the re-election of Mr. WARDLE as President of the Club, said Mr. Wardle had contributed very largely to the success of the Club during the past year. He was foremost in his knowledge of silks, and of the insects concerned in the production of silk, and the work he had contributed showed he was also an excellent geologist. Mr. WELLS-BLADEN seconded the motion, which was carried amid applause, and the PRESIDENT briefly acknowledged the honour paid to him. The other officers of the Club was also re-elected.

The PRESIDENT, who was received with applause, delivered his Annual Address, which he illustrated with a number of lantern-slides. The subject was "The Entomology and Uses of Silk," and it was full of curious and valuable information. At the close of his address the MAYOR

proposed a hearty vote of thanks to Mr. WARDLE for his Address. Mr. WOODALL, M.P., in seconding the motion, said Mr. Wardle was an all-round scientific man. He believed few adequately appreciated the services he had rendered to his country and to the world at large, but he hoped the time would come when his country would accord him some recognition. The motion was unanimously carried, and votes of thanks were accorded to the other officers of the Club, the leaders of excursions, authors of papers and addresses, &c.

The various Sectional Reports were taken as read. Mr. Wardle exhibited a large number of specimens from his famous collection of silks, embroideries, food plants of silk worms, &c., as well as examples of brocades and damasks, manufactured by Messrs. Warner and Sons, of Spitalfields; and Mr. George Bermingham, of Leek. Mr. A. Meigh showed three specimens of live owls; Mr. W. H. Earl, Indian native coins; and the Rev. T. W. Daltry, common bittern and other birds.

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WITH WHICH THE NORTH STAFFORDSHIRE CLUB EXCHANGES PUBLICATIONS.

—)o‡o(—

Brighton and Sussex Natural History Society.
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Dudley and Midland Geological and Scientific Society.
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RULES.

1.—That a Club be formed under the title of the "NORTH STAFFORDSHIRE NATUALISTS' FIELD CLUB," having for its object, the practical study of Natural History in all its branches.

At the Annual Meeting on March 22nd, 1877, the words "AND ARCHÆOLOGICAL SOCIETY" were added to the title of the Club.

2.—That the Officers of the Club be a President, two or more Vice-Presidents, a Treasurer, a Secretary, Local Secretaries and Treasurers, and a Committee of ten members, three to form a quorum.

3.—That an Annual Meeting be held not later than the month of March in each year, for the purpose of electing Officers for the ensuing year, selecting the places for Field Meetings, and transacting any other business which may be brought before it.

4.—That five or more Field Meetings be held during the year in suitable localities, and that timely notice of each be given to the Members by a circular.

5.—That Evening Meetings be held during the winter months, at such time and place as the Committee may appoint, for the exhibition of specimens, and the communication or discussion of any subject connected with the objects of the Club.

6.—That Candidates for Membership shall be proposed and seconded in writing, at any meeting of the Club, and shall be elected at the next meeting by a majority of votes by the members present.

7.—That a subscription of Five Shillings yearly shall be paid by the Members, due on January 1st in each year; and that every new Member shall, on election, pay an entrance Fee of Five Shillings, in addition to the subscription for the current year.

Any Member whose subscription shall be two years in arrear, and to whom formal application has been made for payment, shall, at the end of one month from such application, *ipso facto*, cease to be a Member of the Club.

8.—That the Committee may recommend as Honorary Members, ladies or gentlemen distinguished for their attainments in Natural History, who have in any way contributed to advance the interests of the Club.

9.—That, after providing for the payment of all incidental expenses, the funds shall be applied to the purchase of Books, Journals, &c., or in any other way the Committee may think likely to advance the interests of the Club.

10.—That the Papers which are read before the Society be published either in the Reports or in the Scientific Journals, and also abstracts of the same in the public papers.

11.—That the Club shall do all in its power to discourage the extermination of our native fauna and flora ; the rarer botanical specimens collected at the Field Meetings shall, as far as possible, be such as can be gathered without disturbing the roots of the plants ; and notes of the habits and localities of our fauna shall be recorded, in preference to collecting specimens.

12.—That the Committee have power to make Rules for the circulation among the Members, of Books belonging to the Club.

13.—No Rules of the Club shall be altered except at a General Meeting called for the purpose, notice of which must be given at a previous Monthly Meeting.

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